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1955 ANNUAL REPORT

Secretary of the Interior

DOUGLAS McKAY

*Partnership in
Resource Conservation
and Development*

FOR THE FISCAL YEAR ENDED JUNE 30

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PARTNERSHIP IN RESOURCE
CONSERVATION AND
DEVELOPMENT



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UNITED STATES
DEPARTMENT OF THE INTERIOR
Douglas McKay, *Secretary*

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THE SECRETARY OF THE INTERIOR
WASHINGTON

MY DEAR MR. PRESIDENT: I transmit herewith the Annual Report of the Department of the Interior for the fiscal year which ended June 30, 1955.

The review of the activities of the Department's bureaus and offices which this report provides indicates the substantial nature of the continued progress which is being made in carrying forward the Department's important missions. The report also furnishes a brief examination of the ways in which partnership in resource conservation and development can serve in meeting successfully the tremendous responsibilities which we face today and must expect in the future.

Sincerely yours,

Douglas McKay

Secretary of the Interior.

THE PRESIDENT,
THE WHITE HOUSE,
Washington, D. C.

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PART I

PARTNERSHIP IN RESOURCE
CONSERVATION AND DEVELOPMENT

Partnership in Resource Conservation and Development



THE tremendous task of sound resource conservation and development which today confronts the United States must be viewed in the light of the unprecedented economic and technological advances of mid-century America.

Never in world history has a Nation made more sweeping gains in providing a good way of life for its people.

Our economy, expanding at a breath-taking pace, has more than kept up with the gigantic demands of a record growth in our population. Each year as new families form in burgeoning numbers their needs for an amazing abundance of goods and services are being met with the vast outpouring of American industry and the American farm.

What has this meant in terms of our natural resources?

New families and the advance of the American standard of living to a level never before achieved anywhere at any time has created equally record-making demands on all of our resources—our minerals and energy sources, our forests, our land, our water.

New homes mean that the minerals of the earth must be mined to provide the ores that go into the steel, the aluminum, all of the magic metallurgical combinations that we think of simply as homes, automobiles, and washing machines.

To use our washing machines, our television sets, our automobiles, we must have power, and this power comes from the coal, natural gas, and oil that man must take from the supply that nature has built over millions of years. It means also harnessing the best of our sources of water power to make use of the always renewable energy provided by falling water.

Our land, too, faces ever increasing demands for the food we eat, the cotton for the clothes we wear, and the lumber that our forests can provide for a multiplicity of essential uses.

Increasingly also we are recognizing that we cannot take our water supplies for granted as we soberly view the prospect of the growth of our water needs for industrial and domestic use by 145 billion gallons daily—equivalent to the flow of 11 Colorado Rivers—in the next 20 years.

Meeting successfully all of these tremendous and accelerating levies on our natural resources will not be easy. The task is gigantic and complex. It is also vital to the very continuance of our civilization as we know it.

All of those who have realistically faced the problem will agree, however, that it is a task that must be approached by the American people within the framework of their creative traditions. Clearly, this great joint responsibility can best be met by our system of individual enterprise with the Government working constructively to aid and assist but not to dominate and control.

Sound conservation and development of our natural resources demands a realistic partnership of all of the American people. Federal, State, and local agencies charged with resource responsibilities must provide leadership and guidance. But the basic mission must be that of the whole complex of our free society working inventively and productively as only that type of society can.

In essence the partnership policy is simply the realistic carrying forward in terms of our modern problems of that basic truism of the Government's proper relationship to the people that was so effectively stated by Abraham Lincoln: "The function of government is to do for the people what the individual cannot do at all, or do so well for himself, and in all those things which the individual can do for himself, the government ought not to interfere."

The partnership pattern will vary of course, depending on the particular problems to be faced in each resource area and each of the specific situations involved. Inherent in the partnership concept is the clear recognition that the task is not one for Federal agencies, such as the Department of the Interior alone. Nor is it a task for only State and local agencies, or for private initiative alone. Rather, it is a task in which we can best succeed through a program of close teamwork in which Federal agencies, State and local agencies, and free enterprise work together, each performing the function for which it is best fitted.

In the sections of this report which follow, the specific patterns and approaches under which partnership can serve in meeting our resource conservation and development task will be outlined. In each instance, however, we must bear in mind that no magic formula is being promulgated except the enduring American belief in the productivity of our way of life based on a common recognition of our individual rights and responsibilities.

MINERAL AND FUEL RESOURCES

The policy of participation with all interested parties in the better utilization of mineral resources attained new heights in fiscal 1955. The Bureau of Mines and other Department agencies engaged in scores of cooperative projects in the fields of metallic and nonmetallic minerals and mineral fuels.

Cooperation with Industry

Private enterprise has the major responsibility for resource development in the United States. Consequently, service to and cooperation with industry long have been prime objectives of the Department.

These objectives are attained in many ways, since the interests of industry frequently coincide with those of the Federal Government.

For example, the Government must have detailed information on mineral commodities and the industries that produce them so it can plan intelligently for the Nation's military and economic security. The industrialist also needs such information to make the decisions upon which the success of his business depends.

The Bureau of Mines cooperates closely with industry and with other Government agencies, both State and Federal, in collecting and reporting such information. Virtually all of the Bureau's industry-wide statistical canvasses are partnership projects in which forms are submitted to industry for information and returned voluntarily.

At times, industrial associations find Department facilities and impartial viewpoint useful for carrying out special joint canvasses. Such a canvass, to estimate future cement production capacity was undertaken with the Portland Cement Association to provide the President's Advisory Committee with data for planning a national highway program.

New Mining Methods and Machinery

Efforts to develop new mining methods and machinery to utilize mineral resources more effectively supplement those of industry, and whenever feasible are carried out cooperatively.

Bureau engineers and technologists currently are working with the operators of copper mines in three States—Arizona, Michigan, and Nevada—to develop methods of increasing ore recovery and to learn more about such low-cost underground mining methods as block caving. The use of highly sensitive listening devices that pick up subaudible noise resulting from movement in rocks was developed jointly by the Bureau and mining companies to increase safety and conservation when mining underground rock supports, or pillars.

One Bureau-industry project was an investigation of processes to recover beryllium as a coproduct of lithium from an ore mined in North Carolina.

Another dealt with recovery of alumina from high-silica bauxites and residues from commercial alumina operations, and still another developed an improved process for recovering kyanite-sillimanite concentrates from wastes at a mineral processing plant in Florida.

At one of its laboratories, the Bureau created specimens of low-melting synthetic micas for industry to evaluate as bonding agents for grinding wheels.

Cooperation with Steel Industry

For years the Bureau has worked in close partnership with the iron and steel industry. Recent cooperative projects have ranged from research to develop better methods of producing iron, through tests of anthracite as a partial substitute for coke in steelmaking, to studies that developed two processes for recovering manganese from open hearth steel furnace slags.

One of the most closely integrated company-Bureau projects during the year was the development and trial of a mechanical phosphate rock planer similar to certain coal-mining machines. After designing and constructing the first model, Bureau personnel monitored mine tests in which the cooperating company supplied labor, underground transportation, and facilitating services and tools. As a result, the machine has developed from the experimental stage to a point where commercial use seems assured.

Minerals Exploration

Another outstanding example of successful joint industry-Government activity is the Defense Minerals Exploration Administration Program.

To encourage exploration for strategic or critical minerals, Bureau of Mines and Geological Survey engineers worked together under the direction of DMEA to examine and evaluate specific exploration projects for which Government financial assistance is sought. DMEA projects have been undertaken with individuals, partnerships, and companies.

Developing Fuel Resources

Wise development of our reserves of mineral fuels is essential to our continued security. To assure that succeeding generations will have coal and petroleum to meet demands of the future, the Bureau of Mines cooperates with industry and with Federal, State, and local Governments in encouraging conservation of these commodities.

Cooperative programs are underway with bituminous coal and anthracite operators to cut production costs and increase safety through development of improved mining and roof control methods.

In another cooperative effort, the Bureau is working with private firms to devise a means of gasifying coal underground where it occurs in seams too thin or of too low grade to justify conventional mining. Cooperative research on upgrading solid fuels already has resulted in a process for drying lignite to obtain a fuel for power generation and recover tar as a potential source of chemicals.

The Bureau's coal sampling and analysis work not only enable the Federal Government to purchase solid fuels on a guaranteed quality basis, but also aids industry and State and municipal agencies to do the same.

Cooperative research on production, transportation, and storage of petroleum and natural gas and their products is part of the foundation for conservation of these resources. The continuing benefits of this research have been of great value to industry and also to the tax-paying public.

An early example of industry-Bureau research on petroleum was the development of an oil well casing program to protect underground fresh water horizons and prevent waste of petroleum.

This program was adopted and followed by the industry and by State commissions concerned with oil production problems.

The value of the Bureau's petroleum chemistry and refining studies has been recognized by increased financial support from industry and from other Government agencies until today nearly \$4 of every \$10 spent by the Bureau in this field of research come from outside sources.

The Bureau has cooperated with industry in studies to develop better helium recovery methods and to improve the heating value of certain natural gases. An agreement recently signed with a gas production company enables the Bureau to obtain additional helium-bearing gas for its Navajo Helium Plant from a natural gas that has no value as a fuel.

Oil Shale Research

The Nation's vast reserves of oil shale are an ideal example of a mineral resource that can best be developed by cooperation between Government and private initiative.

The reserves are owned partly by the Government and partly by individuals and corporations. Studies in the experimental mining, retorting, and refining were carried on under an arrangement in which the Department of the Navy permitted use of its oil shale and the Bureau of Mines developed equipment and methods for utilizing it.

Partnership in developing this resource has not been confined to

Government departments, however. Crude shale oil and products from the Bureau's shale oil refinery at Rifle, Colo., were supplied to industry and to other Government agencies for testing and experimentation under 18 cooperative agreements during the past year.

In cooperation with industry, the Bureau last year made more than 2,800 tests of explosives and hazardous chemicals used in mineral production and processing. Conditions leading to gas and dust explosions were studied, as were methods of minimizing explosion damage.

Cooperation With State and Municipal Governments

Much of the Department's work in the fields of mineral economics and health and safety is also of intimate concern to various State agencies, and is best carried out in cooperation with them.

The Bureau of Mines cooperates closely with State agencies in collecting and compiling economic and statistical data on mineral commodities. It has formal cooperative agreements with State geologists or Divisions of Mines in 27 States and Alaska for joint collection of mine production data.

One of the finest examples of State-Federal partnership is the Bureau's Petroleum Experiment Station at Bartlesville, Okla. Since this station, said to be the largest installation of its kind in the world, was established in 1918, the Oklahoma State Government has continuously provided through regular appropriations part of the money for salaries and operating expenses. Technologic developments born of this partnership have benefited not only the petroleum industry and the State of Oklahoma, but also the rest of the Nation.

For many years the Bureau of Mines has worked with State, county and municipal agencies in the business of fighting coal fires on private property. All these agencies have exchanged information freely in controlling fires in abandoned coal mines or in coal beds which are not on the public domain. Moreover, the partnership extends to payment of the cost of fighting these fires. Under present legislation, this cost is borne on a matching dollar-for-dollar basis by the Federal Government and the interested agency, which may be a private coal company, the State, or other political subdivisions.

The Bureau likewise cooperates closely with mining departments of several States in administering the Federal Coal Mine Safety Act and in carrying out its various accident prevention and safety training programs.

Cooperation With Other Federal Agencies

The specialized technical knowledge and facilities available in the Bureau of Mines are used by many other Government agencies in carrying out their work.

Typical cooperative programs currently in progress with the General Services Administration are aimed at developing domestic resources of selenium, recovering columbium from Arkansas titanium deposits, and increasing output and improving recovery of nickel and other metals from deposits at Nicaro, Cuba.

The Bureau also performs mine examinations, metallurgical tests and quality control tests for GSA. Examples are investigation of an asbestos mine in Venezuela, and analysis and laboratory testing of low-grade manganese ores submitted to GSA depots to determine their acceptability and value.

The Bureau has participated in the work of the Atomic Energy Commission to develop resources of radioactive minerals. More than 20 monazite-bearing placer deposits have been investigated by the Bureau, and at least half of these give promise of becoming commercial producers.

In cooperation with the Atomic Energy Commission and the Navy Department's Bureau of Ships, the Bureau of Mines developed methods and constructed and operated the country's only facilities to produce hafnium-free ductile zirconium needed for research in constructing nuclear power generators. This program developed improved methods of recovering metallic zirconium and hafnium at lower cost than are now used by commercial producers.

In 1955 the Bureau of the Census, Department of Commerce, was authorized by Congress to take a census of the Nation's industries and businesses. To minimize duplication, increase effectiveness, and assure complete coverage, the Bureaus of Census and Mines are cooperating on the census of mineral industries. Many canvasses are being conducted jointly, and the information obtained will be of great value both to the Government and to industry.

Oil and Gas Regulatory Activities

Cooperation between the Department of the Interior and the oil and gas regulatory agencies of the petroleum producing States dates back more than 40 years.

In 1914, the Secretary of the Interior offered the services of Bureau of Mines experts to cooperate with State officials in stopping the waste of natural gas in Oklahoma. The Bureau assisted in drafting two laws on oil and gas conservation which were passed in 1915 by the Oklahoma Legislature.

The 1915 Oklahoma oil law has been a beacon in the history of oil conservation.

During the past two decades, the Department has had active and close cooperation with the States in the enforcement of their conservation laws through the administration of the Connally Act, passed

in 1935 to prohibit interstate shipment of oil produced in violation of certain State oil and gas conservation laws and subsequent orders.

Early in 1947 the Secretary of the Interior strengthened cooperation to further oil and gas conservation with the designation of the Director of the Office of Oil and Gas as the Department's official representative to the Interstate Oil Compact Commission.

Since then, the Department has participated regularly in meetings of the Compact Commission, under which member States and Alaska have exercised leadership in improving and standardizing oil and gas conservation practices throughout the country, as well as providing a forum for discussion of conservation and related problems.

PUBLIC LANDS

Partnership arrangements of one kind or another with the Federal Government are the warp and woof of the responsibilities assigned by the Department to the Bureau of Land Management, which exclusively administers some 468 million acres of public domain lands that are almost wholly unappropriated and unreserved.

The Department works with countless individuals, businesses, industries, local agencies, State agencies, Federal agencies, and even foreign nations through transactions ranging from routine land or mineral filings to multi-million dollar undertakings such as those that are developing the resources of the Outer Continental Shelf.

Thousands of such transactions make up the workload of the Bureau, a workload that bespeaks cooperation.

Partnership is reflected in the financial balance sheet and distribution of the Bureau's "earnings." During the nine years since the Bureau of Land Management was formed, receipts have totaled more than \$623,000,000. Of this amount more than \$192,000,000 was transferred to the Bureau of Reclamation for investment in dams and other projects (usually constructed by private contract) for development of arid regions of the West. More than \$169,000,000 was paid to States and counties for schools, roads and other local purposes. Part of the remainder, when appropriated, has been used for improvement of grazing lands, and the balance was deposited in the miscellaneous receipts fund of the Treasury.

During the fiscal year 1955 alone, income from Bureau of Land Management sources amounted to more than \$239,000,000 as compared to its appropriation of \$11,913,000—representing a ratio of \$20 return for every \$1 expended.

Highlights of Cooperation

The historic policy of the United States with regard to the unreserved public domain has been to encourage the transfer of public

lands into private ownership when such ownership can make more productive use of the land resources.

Since the lands remaining in public ownership under jurisdiction of the Bureau are either reserved or less desirable than in the past, the rate of their transfer to private ownership has been considerably retarded compared to the earlier days of the Nation.

As demands for public lands for various purposes have increased, new laws and regulations were put into effect, substantially stepping up the declining transfer rate during the past year.

Some 20 million acres of vacant, unreserved public lands remain in the Missouri Basin, much in the form of less desirable isolated tracts surrounded by private holdings. In the first of a series of carefully planned public sales, the Bureau put 94 of these tracts totaling more than 12,000 acres on the auction block in South Dakota near the end of the fiscal year, with more to follow. In another systematic disposal program, some 112,000 acres of lands restored from withdrawal in Arkansas were also put up for public auction sale.

Some 225,000 acres of previously unsurveyed school lands were made available to Western States through stepped-up cadastral surveys, and a program of lieu selection was worked out so that the State of Washington could take possession of some 150,000 acres of its statehood grant school lands.

Park, Forest, Refuge Areas Preserved

It must be emphasized that acceleration of the rate of transfer of certain public lands to private ownership does not mean that the Federal Government intends to dispose of all the land in unreserved public domain status, nor even of the major portion.

Careful selection is made of the lands to be listed as available for disposal; equally careful selection is made of lands to be withdrawn from unreserved status.

The yardstick in both instances is the course by which the land in question can best be put to its highest and most beneficial use, for the ultimate public good.

National forests, parks, and wildlife refuges are held inviolate, for example. There have been occasions when land exchanges were arranged, usually to achieve uniformity of a tract which would afford better management. Such exchanges have been effected with States or, in some cases, with private individuals when the Federal Government sought to consolidate public acreages or dispose of isolated tracts.

Multiple Use Legislation

The Department was instrumental in laying the groundwork during the past year for passage of legislation that opened to mining location

and development more than 7.2 million acres of public lands long withdrawn for power and water sites, with full protection to the Government if the land should be needed at some future time.

This climaxed two other important enactments by the Congress that were vigorously supported by the Department—Public Laws 585 and 167. These conservation measures provide for fuller utilization of natural resources of the public domain by enabling multiple use of the same tracts of land for all kinds of mineral development and multiple use of the surface resources.

Developing the Outer Continental Shelf

Passage of the Outer Continental Shelf Act of 1953 giving the Department of the Interior jurisdiction over submerged lands in the outer periphery of the Continental United States presented a new challenge to the Department.

Keeping pace with the new technologies which have enabled the petroleum industry to develop oil in deeper and deeper waters of the Gulf of Mexico, the Department successfully mapped 20 million acres of OCS lands off Louisiana and Texas for oil and gas leasing purposes. With the maps, locations of submerged lands can be pinpointed as accurately on dry land by means of their coordinate positions related to fixed monuments on the shore. This enabled the Department to proceed with a new program for unlocking these vast resources—a treasure valued in the billions of dollars.

The oil and gas industry backed their faith in the new program by pouring \$142.4 million into the U. S. Treasury in bonus bids and first year rentals for the right to explore just 489,869 acres for oil, gas, sulphur in the outer shelf off Louisiana and Texas. This resulted from two bid "sales" held in October and November 1954. Preparations were completed for a third sale, held on July 12, which boosted acreage leased to 864,236 and the bonus-rental cumulative total past the quarter billion dollar mark.

Meeting Log Shortage Crisis

District forestry offices of the Bureau helped relieve a severe log shortage crisis resulting from a 1954 summer-long strike that threatened to prolong the shutdown of Oregon's lumber mills through the winter.

In response to an emergency appeal from the Governor and orders from Secretary McKay, 70 million board-feet of timber, in addition to regular output, were rushed from points nearest existing access roads to supply the dire need of the plywood and other lumber mills affected by the strike.

Soil and Moisture Conservation

Plans were completed during the past fiscal year for a long range cooperative program of soil and moisture conservation designed to rehabilitate most of the Federal rangelands in the Western States.

Six Interior agencies will spend \$250 million in a coordinated program of watershed improvement spread over 20 years, ending in 1975.

In addition to appropriated funds, an estimated 40 percent of the total planned operations will be financed by contributions from range users and other private sources and local government agencies.

Range Management

Partnership, particularly during the past year, has been a veritable touchstone to effective administration of the public land grazing resources under the Taylor Grazing Act of 1934.

Wise control of the Federal grazing lands after decades of unregulated use would have been impossible without the voluntary help and support of locally elected grazing district advisory boards. These groups of public-spirited stockmen have spearheaded the Department's drive to effectuate orderly use of the range and apportion grazing privileges equitably among qualified users as called for in the Taylor Grazing Act.

This cooperation has transcended mere lip service. Cash and deeds have supplemented wise counsel. During the past fiscal year, the range users have contributed nearly half of more than \$5,000,000 invested in range conservation and improvement works, not to mention instituting or continuing numerous range improvement practices that have entailed many man-hours of labor and use of private equipment.

Contributions both in money and materials from livestockmen constitute about 40 percent of the total annual investment made in these improvements to the public lands. This has had the effect of sharpening the personal interest of the stockmen. When their personal assets are invested with public dollars in the development of public lands, the result is a greater and more permanent accomplishment.

The planning of conservation and improvement measures on a watershed basis has been virtually completed during the past year. In addition to cooperation with public land users, complete and integrated planning has made it imperative to have harmonious working relationships with other Federal and State agencies having an interest in each watershed. Planning groups, composed of interagency representatives, are employed to assure that all affected interests receive adequate consideration.

Cooperative effort has been most effective in meeting emergencies such as the prolonged drought that plagued the Western range country last year and for several years past. Substantial voluntary reductions in numbers of livestock using the range and rapid development of supplemental water supplies have been accomplished through the cooperation of the range users.

WATER RESOURCES DEVELOPMENT

Greater participation by State governments and local communities, private industries and individual citizens is paving the way for a high level of achievement in water resources development in the 17 Western States and Alaska.

Legislation enacted or pending in Congress at the close of the fiscal year pointed to an even closer partnership in this field of conservation by establishing wider horizons for national economic progress in the years to come.

Cooperation between Government and people in the development of the natural resources in the arid lands of the West has been the traditional policy of the Nation for more than a half-century. It had its beginning in 1902, when President Theodore Roosevelt on June 17 signed the first Federal Reclamation Act establishing a revolving fund of proceeds from the sale of the public lands with which to construct water storage dams and other irrigation works in the West.

Administration of this act and other Federal reclamation laws was vested in the Department of the Interior where it remains today. There has thus been afforded a continuity in technical knowledge, and practical experience in the planning, construction and operation of reclamation projects containing such engineering features as the world's largest and highest dams, water-distributing canals, and hydro-electric power plants.

Reclaiming Arid Lands

As a result of this combination of cooperation and continuity, facilities capable of delivering irrigation water to more than 7 million acres of land have been provided by the Department's Bureau of Reclamation. Individual initiative has resulted in the parallel development of 125,000 family size farms and more than 125,000 suburban units. The area for which water can be supplied from Bureau-constructed works comprises about one-fourth of the total irrigated land area of the western United States.

At the earliest date possible, irrigation facilities are transferred for operation and maintenance by the local water user organizations.

Of the irrigation projects or divisions of projects constructed by the Bureau, 89 percent have been transferred for local operation and maintenance.

Partnership Is Stressed

Fresh concepts of cooperative partnership in the development, planning and financing of water resource conservation programs in the West characterized to a striking degree the administration of the Department during the past year.

In general, this policy anticipates that the Federal Government will provide funds for a part of the cost of features of a multiple-purpose project, such as flood control, navigation, interest on the reclamation investment, and perhaps an advance of some of the cost of the reimbursable features of a multiple purpose project.

The balance of the cost would be provided by local public or private sources. Moreover, if the financing can be placed on a broader base, the responsibility for construction will likewise be distributed among the State, local government and private interests. This encourages local control and ownership of local improvement projects.

Benefits Outlive Repayment

Equally important as the conservation of water resources is the contribution made to the national economic structure by the continuous administration since 1902 of the Federal Reclamation program by the Department of the Interior.

Long after project costs have been repaid fully through the sale of electric energy and operations of repayment contracts, the new wealth created through the Federal investment in the development of its own resources will be reflected in a continuing flow of tax revenues from the project areas and in trade with the rest of the Nation as well.

Developments during the year within the framework of the new partnership and cooperation policy point to increasing opportunities for expansion in the Nation's economic structure under the program.

Take, for instance, the Columbia Basin Project in the State of Washington. Here the largest investor to date has been the United States. As the project develops and private capital is used to develop farms, non-farm businesses, communities, public works, transportation facilities and other activities, the non-Federal investment is expected to greatly overshadow the initial Federal investment in the constructed project features.

Advances for 1955

Other instances of cooperation in the advancement of the Federal Reclamation program during the 1955 fiscal year are:

In Arizona, the second 100,000 kilowatt steam generator at the Arizona Public Service Company's Saguaro steam plant was placed in operation during the year. Through cooperative agreements among the Arizona Power Authority, the Company, and the Bureau of Reclamation, the energy generated in the privately-owned plant is wheeled over the Bureau's transmission system to the Company and the Authority's load centers.

Partnership operation between the Bureau and private and public utilities in the region has enabled the Bureau to fully coordinate its hydro generation with the utilities' steam generation, thereby providing maximum utilization of hydro energy with resultant conservation of natural resources. The Bureau's system has also been utilized to wheel steam-generated energy from Arizona to meet shortages in Nevada.

On the Ventura Project in California, a contract was negotiated with the Ventura River Municipal Water District for advanced planning work for which the district has advanced \$720,000.

Increased emphasis was given to cooperative engineering effort with small irrigation districts. There was continued improvement in rehabilitation, reconstruction and betterment of irrigation projects built many years ago under private initiative.

Indicative of this effort were the rehabilitation of irrigation facilities on the Dalton Gardens and Avondale irrigation systems in Idaho; the rehabilitation of the Isleta Diversion Dam and more than 180 miles of drains on the Middle Rio Grande Project in New Mexico; and rehabilitation of the Savage Rapids Dam on the Grants Pass Project in Oregon.

Power Partnership in Northwest

As marketing agent for the power generated at specified Federal dams in the Pacific Northwest, the Bonneville Power Administration plays a vital role in the use and development of the region's water resources, involving a close working relationship among Federal and local agencies, and other utility systems, both privately and publicly-owned.

At the present time BPA markets power from Federal plants with 3.6 million kilowatts capacity, and an additional 2.6 million kw are under construction.

Partners in Power Operations

Basic to BPA's operations is its relations with the agencies that build and operate the dams and power plants.

The Corps of Engineers operates Bonneville, McNary, The Dalles,¹ Chief Joseph,¹ Albeni Falls and The Willamette Valley projects; the Bureau of Reclamation operates Grand Coulee, Hungry Horse and Chandler.

Advances In 1955

BPA engineers work closely with the Corps and Bureau in the day-to-day operation of the projects, and participate with their engineer in system studies to determine the best methods of utilizing the reservoirs and waterflow of the Columbia River.

Through such cooperation the power plants are fully adapted to system conditions and contribute to the most economical construction costs and maintenance of the Federal generation and transmission system. These economies are reflected in the low cost of power to consumers.

Northwest Power Pool

The Pacific Northwest as a region enjoys the lowest power rates in the United States. An important factor is the integration of the Federal system with the other major utilities in the Northwest Power Pool, a notable example of partnership between Federal enterprise and local public and private enterprise.

The Pool stretches over an area of 700,000 square miles and encompasses 17,000 miles of transmission and over 7,000,000 kilowatts of capacity.

The Pool is a voluntary organization, a sort of confederacy of autonomous electrical systems. Each system is self-administered, and Pool operations are conducted within a broad framework of understanding based on established operating principles. Successful operation of the Pool depends on integration of all the hydraulic and electrical facilities in the combined systems.

There are 142 power plants in the Pool, of which 123 are hydro and 19 steam-electric. Coordination of these power plants spread over 700,000 square miles is necessarily complicated. The Pool has developed a system of reservoir regulation to take advantage of the diverse streamflow patterns in order to best serve its loads. This calls for complete interchange of information between the operators of the Federal system and other members of the Pool. All decisions are voluntary and unanimous and are made within the framework of interutility contracts, both Federal and non-Federal.

¹ Under construction.

The measureable benefits of the Pool may be summarized as follows:

1. It permits the 11 major utility systems to make the most economic use of the energy sources available to the combined systems. The result is a substantial saving in the cost of electricity to consumers.
2. Pool utilities not only obtain energy at lower cost because of economic transfers but also benefit from improved continuity of service.
3. Pool operations permit each utility to save on standby capacity to meet emergencies.
4. The integration of 11 generating and transmission systems adds some 600,000 kilowatts—more than one Bonneville dam—to the Northwest's power capacity without adding extra generators.

Relations with Customers

BPA's relations with its 119 customers—of whom 80 are publicly-owned utilities, 9 privately-owned utilities, 18 industrial plants and 12 Federal agencies, resemble that of a partnership as well as seller and buyer.

Close collaboration with the public and privately-owned utilities—who take over half of BPA's power deliveries—is essential in order to determine loads and the transmission facilities required to meet customer needs. Cooperative studies of load growth and power flows by BPA and its customers serve as a basis for system extensions.

The customers are consulted also in the preparation of proposed construction schedules that are submitted to Congress. At the semi-annual customers' meetings the Administrator discusses with them mutual problems as well as BPA policies and plans.

Power Planning

The major non-Federal utilities, including private companies, municipalities, larger public utility districts and electric cooperatives, are planning additions to their generating systems in order to satisfy the rapidly growing power requirements of the Pacific Northwest.

Currently some 45 new projects are being actively considered by local utilities with a total capacity of almost 8 million kilowatts—in addition to about one million kilowatts under construction or definitely scheduled by non-Federal agencies. BPA is cooperating with these non-Federal utilities in planning the transmission systems from projects under construction or consideration.

Some of the projects, such as Priest Rapids and John Day, are proposed for partnership development, with local utilities financing the power plants and the Federal Government responsible for navigation locks, irrigation facilities and fishways.

An important problem that surrounds nearly all of the proposed non-Federal or partnership projects is the transmission of power to markets.

Generally speaking, the energy produced from these dams must be marketed in more than one load center. Integration with the Bonneville grid and the Northwest Power Pool therefore seems to be vital to their feasibility.

Power Partnership in Southwest

The power marketing program of the Department in the Southwest is conducted by the Southwestern Power Administration.

Because of the characteristics of power supply in the Southwest, the Department through Southwestern Power Administration initiated steps toward cooperation with privately-owned utility systems and with rural electric cooperatives which generate and transmit electric power generated from fuels.

On January 1, 1954, a unique power partnership contract was put into effect in Arkansas. On that day, the Southwestern Power Administration began deliveries of peaking hydroelectric power to the Arkansas Power & Light Company in order to enable that company to supply low-cost electric power to the new aluminum plant of the Reynolds Metals Company, at Arkadelphia, Arkansas. Under this three-party contract, the privately-owned power company and the Federal power system pooled their generating facilities to serve the new electric load.

The recent severe drought in the Southwest greatly reduced the amount of hydroelectric power and energy which had been available to the Southwestern Power Administration for sale and distribution. During fiscal year 1955, contractual and operating arrangements were entered into with privately-owned utilities which permitted all the electric loads in the area to be served without curtailment or interruption.

On June 1, 1955, the Department initiated power deliveries through Southwestern Power Administration for another type of power agreement.

This involved a contract between the Federal Government and the Brazos River Transmission Electric Cooperative, Inc., and between that cooperative and the Texas Power & Light Company. The combination of these two contracts place the Government, the cooperative, and the company in a power partnership.

Under this arrangement, the Government obtains the maximum revenue for the sale of power from the Whitney project; the company obtains the maximum value from the peaking hydroelectric power

generated at that project; and the cooperative obtains the low-cost power and energy which it needs for its members.

During the year the Southwestern Power Administration successfully negotiated a contract with the Arkansas Power & Light Company which will become effective as soon as the Blakely Mountain Dam project on the Ouachita River is placed in commercial operation.

Under this contract, the Company receives the peaking power capability of the project subject to its own needs and the availability of water supply and, at a point approximately 150 miles from the project, delivers to the system of the Government the full rated power capacity of the project.

Thus, the company obtains the high value of the peaking hydroelectric capacity and the Government receives power where it is needed to serve other electric loads without incurring the cost of transmission.

This arrangement permits the Company to coordinate the use of water at the Federal project with the downstream Carpenter and Rammel hydroelectric projects which are owned by the Company, and assures the maximum utilization of the water resources of the Ouachita River Basin.

Power Partnership in Southeast

The statutory responsibilities of the Department's Southeastern Power Administration are carried out by means of cooperative contractual arrangements which the agency has or is negotiating with the operators of public and private power systems having transmission and generating facilities.

The scores of preferred agencies located in the Southeast are scattered over wide areas. In order to avoid either excessive restrictions in the number of preferred agencies receiving power or prohibitive construction costs, it has been desirable to seek cooperative arrangements with the operators of transmission systems where excess capacity is available in such systems.

Only through such arrangements can the requirement for widespread use at the lowest possible rates be met.

Since adequate facilities are generally in existence to carry power from the projects to customers, cooperative arrangements permitting the use of such facilities to transmit power from the projects result in the cheapest means of delivering power.

The Federal hydroelectric developments in the Southeast for which Southeastern Power Administration is the marketing agency have operating characteristics such that power produced at these projects is usable by more preferred agencies only if it can be supplemented by fuel-generated energy during certain hours of the day when the hydroelectric plants are not operated in order to conserve water.

There presently exists contractual arrangements between the Department of the Interior, acting through Southeastern, and the Tennessee Valley Authority, the Virginia Electric and Power Company, a privately-owned company, and the South Carolina Public Service Authority and Greenwood County Electric Power Commission, both agencies of the State of South Carolina, whereby their transmission facilities are utilized in transmitting power from Federal projects to preferred agencies and the operation of the Federal hydroelectric projects is integrated with the operation of fuel-generating facilities thus making power available on a usable basis to preferred agencies.

Desalting Saline Water

Our rapidly increasing industrial and agricultural production coupled with an ever-expanding population over the past quarter of a century has brought about a tremendous increase in consumption of our water resources. In some areas serious water shortages exist at the present time which emphasizes the fact that our water resources are gradually being overburdened, exhausted, contaminated, or both.

The Department is continuing a research program aimed at developing economically feasible processes for converting saline water to fresh water suitable for municipal, industrial, agricultural and other uses. The program is directed equally to the reclamation of inland saline waters and conversion of ocean water. Attainment of this goal would go far in conserving and increasing the water resources of the Nation.

This activity is primarily a cooperative endeavor with private groups.

The Department carries out the program by: (1) Stimulating the interest of private and public organizations and individuals in the problem and encouraging research and development by correlating and coordinating activities in this field, and (2) conducting scientific research and development by means of federally financed grants and contracts and by a limited amount of research in Federal scientific organizations.

Not only is cooperation and coordination of saline water research activities carried out with private groups, such as State education and research foundations, private research institutes, and industrial institutions, but also with the various other governmental agencies in which there is an interest in the problem.

Such agencies include the Department of Defense, Atomic Energy Commission, Civil Defense Administration, National Science Foundation, Smithsonian Institution, Department of Agriculture, Department of Commerce, Department of State and the International Cooperative Administration.

Progress is being made in the development of practical processes for converting large quantities of saline water to fresh water. However, lowering of process cost to an acceptable level is a very difficult problem to be solved. The results obtained so far are sufficiently promising to indicate that with sufficient time economically feasible processes for the demineralization of both brackish waters and sea water are likely.

Progress in cooperation and encouragement of private groups in the development activities is exemplified by a number of research contracts now in effect, and in the promising results being obtained.

For example, in cooperation with one company a new method of distillation which is particularly applicable to sea water conversion has been developed and is now ready for testing under field conditions. Another industrial firm has received contracts for the design, construction and testing of progressively larger electric membrane demineralization units which appear promising for brackish water conversion. Field testing of the membrane type of equipment is now in progress and is carried out in cooperation with State, local and private organizations.

As another specific example, the solar distillation process is being investigated by three different contractors. These investigations have resulted in a comprehensive evaluation of all work in this field, new designs for solar stills and the development of cheaper materials of construction. Both the Department and these contractors are cooperating in supplying technical papers and exhibits for an international symposium on Applied Solar Energy.

INDIAN AFFAIRS

Indian lands and associated resources, unlike most other lands and resources with which the Department is directly concerned, are the property not of the Federal Government but of individual Indians and Indian tribal groups. The Federal Government's basic role in connection with these resources, which is exercised by the Department's Bureau of Indian Affairs, is that of a trustee holding title to the lands for the use and benefit of the Indian owners.

In the fiscal year 1955, the principle of partnership in the management, conservation, and development of Indian lands and their associated resources was broadened and strengthened on several fronts.

The Bureau's encouragement of Indian participation in such matters has been producing positive results. Several tribes realizing the importance of their land and other resources as the principal source of tribal income, have not only been taking an active part in the management of these resources but also have contributed substantial

amounts of tribal funds towards their protection, development and improvement.

Cooperation on Indian Health Problems

Cooperation between the Bureau of Indian Affairs and the United States Public Health Service in dealing with Indian health problems has been going on for many years. In fact, the Public Health Service has played an active part in the attack on these problems not only by providing technical advice and assistance but also by assigning physicians and other personnel in its commissioned corps for terms of duty at Indian hospitals and other field installations.

In recent years, the Indian Bureau has been obtaining a major share of its professional medical personnel by assignment from the Public Health Service. On July 1, 1955, this process reached its logical culmination when the Public Health Service took over full responsibility for the Indian health program under the provisions of Public Law 568 of the 83d Congress.

Despite this shift in basic responsibility, however, it is fully anticipated that the excellent cooperative relationships which have been developed between the two agencies over the years will be maintained and strengthened.

Advances in Indian Education

Cooperative action has been of major importance in the education of Indian children.

Since enactment of the Johnson-O'Malley Act in the mid-1930's, the Bureau of Indian Affairs has been contracting annually with State Departments of Education and local school districts for education of Indian children in public schools. In fiscal year 1955, such contracts were negotiated in 20 States and the Territory of Alaska, providing school opportunities for about 36,000 Indian or native children.

In addition to this perennial cooperation with State and local school authorities, collaboration of a much more extensive nature took place during the year under the Navajo Emergency Education Program.

To achieve the ambitious first-year goal of the program—provision of educational opportunities for an additional 7,000 Navajo children—the Bureau of Indian Affairs solicited and received cooperation from the public schools in the area, from a wide range of community organizations and agencies in the surrounding towns, and from the Navajo tribe itself. Congress provided the funds, necessary to the Department's effort.

As a result, the first-year goal not only was achieved, but exceeded. Total enrollment of Navajo youngsters in schools of all sorts in-

creased from 16,215 at the close of the fiscal year 1954, to 23,679 at the end of fiscal 1955.

Mere statement of the statistics cannot completely tell the story. There is a warm, human element to it which sets of figures standing alone cannot convey. Social progress for a large group is involved, as well as laying the groundwork for good citizens of tomorrow.

In June of 1953, there were about 28,000 Navajo children in the normal school age bracket of 6 to 18. Of this number, almost exactly half were enrolled in schools both on and off the Reservation.

The other half, including many youngsters 15 or 16 years old, never had seen the inside of a classroom. They were growing up totally illiterate.

This startling circumstance called for swift and sweeping action by the Department.

With excellent cooperation from Congress in providing the necessary funds, the Department went to work to correct the situation.

Trailers and quonset huts were pressed into service. Existing Reservation schools were enlarged and reorganized to provide a maximum of classroom space. Arrangements were made with nearby communities to receive the older Navajo children in the regular public schools and to have them provided with room and board at Government expense.

All along the line, throughout the arduous months of the program's progress, the utmost cooperation has been extended from every quarter. The program is continuing unabated, and is expected by the middle of fiscal 1956 to have progressed to a point where educational facilities will be available for every school age youngster in the Navajo tribe.

Here is an instance in which partnership—the pooling of effort—has paid immeasurable dividends in development of human resources.

NATIONAL PARKS

Primary concern of the National Park Service is with people and with the provision of a means for them to use profitably the increasing amounts of leisure time they enjoy.

For this reason, the work and the objectives of the Service with respect to natural resource conservation and development differ fundamentally from those of other Federal agencies.

To accomplish its objective, the National Park Service has the responsibility of protecting and preserving major scenic, scientific and historic areas of the United States.

Expenditure of public funds at all governmental levels must be geared to the realization that parks are closely related to progress in

all forms of endeavor. Otherwise, they are not going to properly serve the America of the future.

Every dollar prudently spent for park purposes is an investment in the future of our Nation and our people.

It is necessary for the National Park Service to seek and to extend cooperation in many different ways. Cooperative effort is required in the development and management of areas for which the Service is responsible; it is required to meet closely related responsibilities acquired by the Service in the years since its establishment.

Cooperation With Other Agencies

Numerous other Federal agencies are involved in cooperative agreements with the National Park Service. Agencies of the various States often are parties to such efforts as are, to a growing degree, private individuals and groups. Each in his own way contributes to the hastening of achievement of common goals.

The National Park Service forms partnerships with the Bureau of Reclamation and the Corps of Engineers to appraise possible recreational "dividends" accruing from construction of dams and reservoirs.

Detailed planning of recreational developments on reservoirs constructed by these other agencies makes the Service's recreational "know-how" available on a cooperative or partnership basis.

The Service is progressing steadily in its expansion to meet growing needs and toward more efficient and effective administration.

Increased appropriations granted by Congress permit the Service to provide more adequate staffing, and to better manage the areas in its care.

Expanding the Parks

The National Park System today is larger than it has ever been. Since 1953, some 125,000 acres of parkland have been acquired and the boundaries of Everglades National Park were extended to take in an additional 271,000 acres.

Efforts are being made to advance a partnership program for park road construction under which problems of construction and maintenance would be worked out cooperatively with the affected States.

For more than three decades the Bureau of Public Roads has provided engineering and supervision for construction of major roads in areas administered by the National Park Service. This arrangement has assumed greater importance during the past year, with the allocation of more funds than at any previous time in the Service's history for construction of roads, trails and parkways.

Work on Park Roads Accelerating

A total of \$35 million has been authorized for roads and trails during the three years beginning with fiscal 1955. The three-year total for parkways is \$30 million.

Appropriations and contract authorizations within these sums are permitting the National Park Service to complete important roads on which progress has been halted, such as the Stevens Canyon Road in Mount Rainier National Park. The Service is enabled to provide additional road mileage in recently established areas, and where the need is most urgent to modernize roads either worn out under the present traffic load or unsuited for modern traffic.

Forests of the national parks are more than essential elements of scenic beauty.

They include extensive stands of the most majestic forest growth in the United States. It is both natural and necessary that there should be the closest inter-agency cooperation in the protection of this resource against fire, insect infestations and disease.

The National Park Service has as partners in this protective function the Forest Service of the Department of Agriculture, State forestry agencies, and private forest protective groups.

Problems involving non-Federal holdings within the established boundaries of National Park System areas are being met in part through authorizations to exchange these lands for lands in the public domain.

Best use of this authorization depends for its effectiveness upon the cooperation of the Bureau of Land Management, which has been extended freely and intelligently.

Notable examples are the steady progress being made in "blocking up" Federal ownership in Joshua Tree National Monument, and, more recently, at Saguaro National Monument. In this latter instance, an agreement has been reached on an exchange with the State of Arizona.

In performing such tasks as the survey of the recreational resources of Alaska, the National Park Service has called upon such agencies as the University of Washington and the National Recreation Association to handle certain special phases of the study.

In the historical and geological study of the Cape Hatteras National Seashore Recreational Area, now in progress, the Service is receiving valuable assistance from the Office of Naval Research and from the Laboratory for Marine Studies of the University of Louisiana.

Mission 66

The endeavor to formulate a long range plan for the development and management of the National Park System—designated as Mission 66—has revealed numerous partnership opportunities.

In its earliest stages, Mission 66 disclosed the absolute necessity for close cooperation between the National Park Service on the one hand, and the Forest Service and other land management agencies on the other, if the forward-looking program is to come to its fullest realization.

The effort to bring about, as rapidly as conditions will permit, removal of public use developments which encroach seriously on major natural features also will require partnership activity. It is contemplated that these public use developments would be relocated outside of park boundaries on lands administered by other agencies, insofar as possible.

Improved roads and more rapid transportation have lessened the necessity for placing all such facilities inside extensive park areas. Thus, the way has been opened for their gradual removal to other sites involving less serious impairment of the natural scene.

There has been a close though informal degree of cooperation between the National Park Service and State agencies, from the early days of the Service. Since 1936, cooperation in planning has been a Service responsibility stipulated by Congress, to be exercised only upon request of the responsible State authority.

Closely related is the task of investigating surplus Federal properties sought by State or local agencies for recreational or historic site purposes. During the past year there were 11 such investigations in 8 States and the Territory of Hawaii.

Partnership with Private Enterprise

Yosemite National Park for the first time is on the way to having fully adequate telephone and radio communications, to be furnished by the Pacific Telephone & Telegraph Company. A similar arrangement is being worked out for most of Sequoia and Kings Canyon National Parks. This is expected not only to provide first-rate service, but also to save the Government about \$6,000 a year.

These are examples of the kind of progress which is being made steadily, in getting out of certain types of activity which are unduly costly and in which the Service cannot expect to attain satisfactory proficiency.

Ten of the areas administered by the National Park Service benefited from completion of such arrangements during the year, and others are projected.

The past year has seen continuance of an important trend of contributions to advancement of National Park Service objectives, by private individuals, corporations and foundations.

As long ago as 1920, the Congress authorized acceptance of donations to be used in furthering Service projects for the public benefit. In 1935, it created the National Park Trust Fund and Trust Fund Board. Both recognized that the objectives of the Service and the National Park System it manages are a particularly desirable field for benefactions. Donors appreciate that lasting benefits will result.

A notable case was the contribution last year of \$500,000 by Jackson Hole Preserve, Inc., to match a Federal appropriation. This non-profit corporation established by John D. Rockefeller, Jr., also provided funds for the new Jackson Lake Lodge completed this summer in Grand Teton National Park.

In all these varied cooperative activities, the cause of Federal economy is advanced, there is a fair sharing of responsibility among public and private agencies, and the goal of adequate outdoor recreational opportunity for everybody comes more nearly to realization.

FISH AND WILDLIFE RESOURCES

Wildlife management is proving to be one of the most challenging problems in the field of natural resource development because of the ever-mounting number of people and the increased competition for land use.

In meeting common problems of resource development, the Department of the Interior has encouraged the philosophy of a working partnership among the Federal Government, State and local governments, and private interests.

On of the most satisfying experiences of the past year for the Fish and Wildlife Service has been the progress recorded in implementing this philosophy by bringing the Service closer to the States and local communities in the truest sense of partnership.

In every field in which the Service operates, greater effort was directed to cooperative participation and understanding. As a result, the foundations have been laid for one of the most rewarding eras in the history of wildlife conservation in this country.

Aware of the rapidly increasing number of sportsmen and the proportionately greater demands year by year upon fish and wildlife resources, the Service is proceeding as expeditiously as it can in expanding its activities to meet these growing needs.

Expansion of Wildlife Refuges

Since 1953, eight new wildlife refuges have been established and three more are in process of being established. Presently the Service administers 264 national wildlife refuges in 42 States, Alaska, Hawaii and Puerto Rico, as well as 89 fish hatcheries in 42 States.

In all, almost 80,000 additional acres have been acquired for wildlife preservation.

Conversely, the Service and the Department has resisted efforts to reduce the effective work underway in any of these areas.

Waterfowl Management and Protection

Great strides are being made toward improving cooperative ties between Federal and State governments in the management of migratory birds.

Within the past few years all States have organized their waterfowl management programs along flyway lines—the flyway being the unit of management for migratory birds. This action has led to a better understanding of the problems associated with waterfowl management.

The Service has encouraged this organized endeavor by frequent meetings with the Flyway Councils to consider waterfowl management problems. Each of these organizations is represented on the Director's Advisory Committee on Waterfowl so that the State and local viewpoint is presented to the Service before the annual hunting regulations are amended.

Surveys made on the waterfowl breeding grounds are also cooperative in nature.

The Fish and Wildlife Service, the Canadian Wildlife Service, the Provincial Game Branches, and Ducks Unlimited combine their manpower and equipment to cover all of the important nesting areas in Canada. Service biologists cover the important areas in Alaska, while the State conservation agencies, with some help from the Service, carry on surveys in about 25 States.

A vigorous program of land acquisition, to assure living space for waterfowl and other migratory birds, continues as a high priority need in the over-all protection program. Both State and private groups are assuming greater responsibilities each year in supplementing Federal programs in this connection.

Ban on Baiting Continued

The Department has held firm to the ban on baiting—an important though controversial aspect of waterfowl management and protection.

In California, most of the natural waterfowl wintering areas have shrunk because of agricultural expansions. California winters most of the waterfowl of the Pacific Flyway, but the State no longer has sufficient natural habitat. In search of food, the birds concentrate in the three great valleys of California—the Sacramento, the San Joaquin and the Imperial.

Heavy damage to California crops resulted from this concentration. Over the years, several methods of frightening the birds away from

unharvested or growing crops were utilized, with varying degrees of success.

In 1953 the California State Legislature approved an act designed to relieve crop depredation by migratory waterfowl through permitting the feeding of birds to attract them away from crop areas. Specified conditions were adopted by the California Fish and Game Commission.

The Fish and Wildlife Service has maintained close watch on the experimental feeding program, with the determination that it should not result in abuses which would lead to revival of baiting. It has been made clear that nothing in the California regulations are to be construed as license to violate the Federal ban on baiting which applies to all 48 States.

Cooperation in Wildlife and Fishery Research

Basic to the management of wildlife resources is a knowledge of game and fish populations.

This is common ground for Federal and State administrators regardless of which eventually exercises jurisdiction. Not infrequently, local and private interests are directly concerned. In this area of common interest, cooperative effort is a recognized necessity and an accomplished fact.

In studies of bird migration, 48 State conservation agencies and numerous universities and scientific organizations cooperate with the Service in banding thousands of birds to trace their migration routes.

"Team" Research Extended

The concept of team research—bringing together specialists in several fields to concentrate upon a complex research problem—has been greatly extended in fishery research during the past fiscal year.

Devices proving effective and advantageous to both "partners" include: Contract research with universities, marine laboratories, and oceanographic institutions; cooperative arrangements with State fishery research units for joint work on problems of mutual interest; and invited participation on cruises of research vessels of specialists in fields related to or supporting fishery biological research.

Commercial Fishing

Faced with increasing fishing effort in Alaska and a serious decline in certain of the salmon runs due in part to unfavorable natural conditions, the Service in 1954 imposed drastic restrictions on commercial fishing in Prince William Sound and southeastern Alaska and re-

doubled its enforcement efforts to provide more adequate seeding of the pink salmon spawning streams.

Although seriously affected by these restrictions, the salmon industry cooperated to the fullest extent. Cannery operations were consolidated and the plans of operators and fishermen alike were tailored to achieve a substantial reduction in fishing intensity.

Initial results of this vigorous restoration program are encouraging. Increased numbers of spawning pink salmon have brightened the prospects for larger runs in those areas in 1956 and succeeding years.

In fisheries exploration and gear research, cooperative effort is producing valuable discoveries and developments. Commercial fishermen, industry members, and local fishery commissions are consulted in project planning. Researchers from universities and State and private agencies accompany Service research vessels and contribute special skills and knowledge to the problems of finding, evaluating, and efficiently utilizing fishery resources.

In cooperation with the Navy Bureau of Ships, underwater television has been adapted to the study of fishing gear. Service specialists advise commercial fishermen on the proper gear and equipment for entering new fisheries, such as the recently discovered Gulf of Mexico tuna grounds.

Saltonstall-Kennedy Program

In fiscal year 1955, under the terms of the Saltonstall-Kennedy Act which was approved by the President on July 1, 1954, the Service embarked upon a research program designed to help the ailing commercial fishing industry of this country to expand production and to develop new markets for fishery products.

In order to produce practical results for the industry in the shortest possible time, the Service, the States, and the industry joined forces in drafting a research and development program.

Now, at the end of the first year of this new coordinated Government-industry effort, it can be said that the American commercial fishing industry is in a better position to realize its production and marketing potential than at any previous time in its long history.

Controlling Predatory Animals and Harmful Rodents

An excellent example of a highly successful partnership is that participated in by the Service and the farming and stock raising industries of the country to protect livestock and crops from depredations by predatory animals and destructive rodents.

Savings amounting to many millions of dollars annually have resulted, at a relatively slight cost. Cooperators paid 82 percent of the total cost in the past year.

Fish Hatchery Operation

The Federal program for stocking fish in inland waters is being carried on in cooperation with the States to provide better sport for the millions of licensed fishermen.

In fiscal year 1955, the Service operated 89 fish hatcheries in 42 States as its contribution to the maintenance of the sport fishery resource. A large percentage of the fish reared in Federal hatcheries was liberated in waters on Federal land, near military installations and veterans hospitals, and on State-Federal management areas.

Federal Aid Restoration Programs for Sport Fish and Wildlife

Another outstanding example of the partnership concept is the Service's Pitman-Robertson and Dingell-Johnson programs.

Under these programs Federal funds from the excise taxes on sporting arms and ammunition and sport fishing gear are matched in the ratio of three to one with State hunting and fishing license revenues to restore and improve the living conditions for fish and game. The projects are selected and planned by the States and, after approval by the Fish and Wildlife Service, are carried out by the respective State fish and game departments, with the resulting improvements belonging to the States.

The Pittman-Robertson program for wildlife has furnished the vehicle by which the States cooperate with farmers, ranchers, soil conservation districts and others in the planting of food and cover to improve game environment. Each year several thousand new game areas are created in the gullied portions or odd corners of cooperative farms.

With Dingell-Johnson funds many new fishing lakes were developed last year on lands acquired and donated to the States by private individuals and sportsmen's clubs. In several States large scale lake rehabilitation projects have been carried out as cooperative ventures.

One of the most important cooperative research activities is a study of the striped bass on the Atlantic coast. The investigations are guided by a coordinating committee representing the Atlantic States Marine Fisheries Commission, with the Fish and Wildlife Service providing technical direction.

PARTNERSHIP PROGRESS IN THE TERRITORIES

Within our Nation, there are few areas where the concept of partnership in the conservation and development of resources is more meaningful than in the Territories of the United States.

In most of these areas the hope of economic and political progress in the future is dependent upon wise application of cooperative principles today.

The essence of this partnership is found in two kinds of cooperative adjustments: The relation of the Federal Government to territorial and local Governments, and the relation of all governmental institutions—Federal, territorial and local—to the initiative and enterprise of territorial citizens.

In past years, the trend toward Federal interferences and dominance had come to be regarded as desirable in itself, independently of its results.

In the Territories—though in some more than others—the Federal Government completely overshadowed local governments, while private and free enterprise often had become neither private nor free.

In Alaska, for example, land withdrawals were made on the theory that only the Government knew best. Land titles were so entangled with procedural red tape that it sometimes was difficult for an Alaskan to acquire legal ownership of his own home.

An effort is now being made to change this trend.

Transfer of Responsibilities to Local Governments

In the Territories this has meant a transfer of Federal responsibilities to territorial and local Governments, wherever those responsibilities can better be exercised by the local Governments. It has meant also a renewed emphasis upon private rather than Government enterprise, with the Federal Government ceasing to perform economic functions which are not normally within its sphere, and which individual citizens or groups of citizens are prepared effectively to undertake.

Finally, it has meant a policy of affirmative aid and encouragement to programs of economic development by the Federal Government when such a course is deemed in the best interests of all of us.

Expressed in these terms, the partnership principle is by no means inflexible.

The usually varying and often unique characteristics of many of the Territories make possible and, in fact, require differing applications of the principle. In a sense, they are workshops for testing new ideas and differing techniques in applying the concept of partnership to particular times and circumstances.

While the ultimate goals can be the same fundamentally, it would be quite unreasonable to attempt the same methods of cooperation in conserving and developing both human and natural resources in a primitive Pacific island as in modern and politically mature Hawaii. In Alaska, with the Federal Government owning more than 90 per-

cent of the land, economic problems cannot be handled in the same fashion as in California or Hawaii.

The Alaska Railroad

Thus, the Department of the Interior continues to operate The Alaska Railroad. This is not because of a belief in the inherent superiority of Government enterprise, but because the Railroad as yet cannot be operated in accordance with the economic standards which normally prevail in private business.

On the other hand, the Railroad has divested itself of such subsidiary activities as the operation of river boats and the maintenance of commissaries, because these operations were ready to be assimilated within the ordinary scope of business operations.

It has been emphasized that a cardinal feature of our territorial policy has been decentralization of responsibility by transferring from the Federal Government such functions as the Territories can handle effectively.

For politically mature Territories, such as Hawaii and Alaska, this means taking over from the Federal Government all those functions that customarily are performed by State Governments elsewhere.

In Hawaii this process has advanced to such a degree that the Territory is ready for statehood. Military and economic problems so far have delayed a similarly direct solution as applied to Alaska.

Several events of the past year illustrate the Department's concept of partnership as between the Federal Government and Alaska's Territorial Government.

For many years the care of Alaska's mentally ill has been a Federal function administered by the Department's Office of Territories. The Department has devised a program for transferring this function to the Territory of Alaska, and has drafted legislation to implement that program.

To help solve financial problems incident to the transition to territorial control, the Department has proposed Federal grants for construction of mental hospital facilities in Alaska and for aid in meeting operational expenses during the initial years. Granting of substantial acreage of Federal land also has been proposed as a further aid.

Highway Development In Alaska

Highway development in Alaska is another example of progress resulting from the Federal Government working in conjunction with the Territory.

For a half-century the construction and maintenance of primary or "through" roads in Alaska have been solely a Federal responsibility.

Most of this responsibility has been exercised by the Department of the Interior through the Alaska Road Commission which operates with Federal funds.

During the 1955 session of the Territorial Legislature, the Governor urged and the Legislature approved an increase in the motor fuel tax which would make more territorial funds available for highway expansion.

By increasing the total amount of territorial money available for road building and maintenance, Alaska is assuming at least a portion of the responsibility which in the past has been shouldered by the Federal Government.

The contribution of highway facilities to development of resources is readily discernible.

Liquidation of PRRA

Final liquidation of the Puerto Rico Reconstruction Administration should be mentioned as another example of transfer to a Territory of what had been a major Federal responsibility.

This Federal agency was born of depression and performed an essential function during a time of hardship in Puerto Rico. Meanwhile, Puerto Rico has become a Commonwealth of the United States, and the emergency for which the Puerto Rico Reconstruction Administration was created has passed into history.

The agency has been liquidated completely, and several millions of dollars returned to the Treasury.

Such economic functions of the defunct Federal agency as the Government of Puerto Rico wishes to perform now will be a Commonwealth responsibility and not one of the Federal Government.

As another example, the public works for the Virgin Islands—which has been administered by the Department of the Interior—is being transferred to the Virgin Island Government under a Revised Organic Act.

Withdrawal From Non-Government Functions

In the development and conservation of resources, economic cooperation means not only withdrawal from activities in which the Government has been competing with its own citizens, but it means affirmative aid in those instances in which the Federal Government can assist its citizens to do a better job.

Action of The Alaska Railroad in disposing of commissary and river boat operations is illustrative of the first sort of partnership between government and industry.

Similar consideration has been shown for the economic interests of citizens in other Territories.

In the Virgin Islands, the Federal Government has gone out of the hotel business and has sold a Government distillery.

In the Trust Territory of the Pacific Islands, the Department of the Interior has liquidated a Federal Agency, the Island Trading Company, which had been engaged in trade and distribution operations throughout the islands. Economic functions of the agency have been turned over to native-owned trading companies.

In American Samoa, the Department of the Interior has leased a government-owned fish cannery, and as a result exports of that Territory have doubled in value in one year.

Aid In Resource Development

Alaska provides dramatic examples of Government aid and encouragement in the conservation and development of resources.

The Department of the Interior is in the forefront in this sort of Federal activity through the work of the Office of Territories, Bureau of Mines, Geological Survey, Bureau of Land Management, Bureau of Reclamation, Fish and Wildlife Service, and Bureau of Indian Affairs.

The record bears ample testimony to the beneficial effect these various Federal activities have had upon Alaskan development.

One of the Federal aids in the development of Alaska to which the Department of the Interior can point with particular pride is The Alaska Railroad.

During fiscal year 1955, the Railroad enjoyed one of the best years in its history from a financial standpoint. At the same time, it improved its train schedules and its service to shippers.

Plans are far advanced for a seatrain service to Alaska which gives promise of bringing a revolutionary and beneficial change to Alaskan shipping habits. This is expected to be accomplished through cooperation between The Alaska Railroad and a large ocean shipping concern.

Through the work of Department's Alaska Road Commission, more than 3,000 miles of high standard highways have been constructed and are being maintained throughout the Territory. Much of this highway mileage is kept open during the winter months.

The Alaska Public Works Program has continued to make possible additional schools, water systems, paved streets, sewers and other utilities in Alaska's fast-growing communities.

Partnership Aids Industrial Development

On the industrial front, one of the greatest accomplishments thus far has been the building and operation of a \$50 million pulp mill near Ketchikan. This achievement was made possible through partnership among Federal and Territorial Governments and private business.

The mill has completed its first year of operation, using logs secured not only by its own force of loggers but those purchased from surrounding communities as well. Thus, its economic benefits have been distributed over a wide area of Alaska. This mill represents the first large scale use of the rich timber resources of the Tongass National Forest.

The Ketchikan pulp mill is a forerunner of similar developments elsewhere in the Territory. At Wrangell, Juneau and Sitka there is more than just a possibility of other large scale uses of Alaska timber. At Wrangell, contracts have been awarded, and at Juneau the timber to be utilized has been advertised for bid.

All these developments are based upon Federal encouragement of private use of publicly-owned timber. Their success depends upon continuance of a partnership arrangement between business interests and the Federal and Territorial Governments.

Petroleum Development In Alaska

The search for petroleum in Alaska again exemplifies the partnership principle.

Here also the Government, as landowner, must establish the conditions which will make resource development possible. These conditions have been established in Alaska, and during the 1955 fiscal year the Bureau of Land Management leased oil rights on more than 500,000 acres. Drilling is underway in several areas around Cook Inlet and in the coastal area east of Cordova.

In addition, the Department has made representations both to the Congress and to the Department of the Navy, looking toward modification of Public Land Order 82 so that 25 million additional acres of Alaska land with oil-bearing possibilities and located outside Naval Petroleum Reserve No. 4 can be opened to exploration.

With so much activity in regions where geologic characteristics are so promising, it seems likely that the search for oil in Alaska will be rewarded with major strikes.

Cooperative Activities In Hawaii

In Hawaii, land for pineapples and sugar, and climate and scenery for tourists are major resources. Cooperation in their development

and exploitation has emphasized partnership between the Territory and private industry, with the Federal Government occupying scarcely more than a junior-partner role.

Other than the Hawaiian Islands, Pacific areas cannot show similar large scale partnership results because, in general, their resources are quite meager as compared with either Hawaii or Alaska.

Nonetheless, in highly important ways the partnership principle has been extended to them, with the Federal Government necessarily in a senior-partner role.

Aside from the transfer of trading operations from a Federal agency to island-owned companies, already mentioned, the Federal Government fosters sea and air transportation in Pacific island areas, promotes introduction of new crops such as cocoa, encourages more widespread native ownership of land, assists the islanders in eradicating insect pests, and promotes health and education programs.

CONCLUSION

As this report has indicated, partnership offers a bright hope for meeting soundly and aggressively our pressing resource problems of today and those that are certain to face us increasingly in the future.

Our resource problems are twofold, involving both conservation and development. In terms of development we must make available and use our resources on a tremendously expanded scale. In recent years the dynamic energy of American technology has provided what is perhaps the prime key to this phase of our resource future.

Technology has shown us the way to make better and more complete uses of our old resource standbys—such as wood and coal—as well as enabled us to develop an almost infinite variety of new materials from hitherto little used sources. We make a host of synthetics from coal tars; we take nitrogen from the air and magnesium from the oceans; titanium, zirconium, the rare earths, and many other new metals have emerged with vital roles to play in our exciting industrial drama.

Chemical technology has, indeed, opened wide the casements to a brave new world in which our material needs may be met on order—if we describe the properties of the new substance or material we need, chemistry stands ready to produce it. Our plastic industry for instance, only a few years ago in its infancy, has grown overnight into a new productive giant through its ability to tailor new products from cheap and virtually inexhaustible raw materials.

The doors that atomic energy and other products of our inventive genius will ultimately open we can only guess. But we can be confident that our path leads onward to a constantly better life for all our

people as long as we stand firmly by the principles of creative enterprise and constructive teamwork in a partnership attack on the vast problems of sound resource development.

The second, and equally important phase of our resource mission, must be conservation for ourselves and for future generations, of the best and greatest of our heritage of natural beauty.

In our immediate preoccupation with our resource development goals, we cannot forget that man lives for more than material things. The need for surcease from the very technology which offers us so much material progress grows apace as our population grows and our civilization becomes ever more complex and mechanized. We need to freshen our spirits occasionally with the peace of untrammelled nature, with the pure joy of birds in flight, and glimpses into the eternal mystery of our destiny that come to us most often in communion with the things that God, not man, has made.

Thus, we must jealously guard the beauties of our parks and wild-life refuges placed in our trust for our own enjoyment and for that of our children far into the future.

If we keep our eyes firmly fixed on this dual resource task—development and conservation—we shall continue through a partnership of all the American people to use our resources for the perpetual progress of man to heights which today we can only dimly sense.

PART II

ANNUAL REPORTS OF THE
BUREAUS AND OFFICES OF THE
DEPARTMENT OF THE INTERIOR

Office of the Assistant Secretary Water and Power Development

Fred G. Aandahl, *Assistant Secretary*



THE Assistant Secretary—Water and Power Development—is responsible for the supervision and direction of the water and power agencies of the Department. These are the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and the Southwestern Power Administration. The latter three agencies are solely marketing agencies for the sale of surplus electric power generated at Federal dams in their respective areas. The Bureau of Reclamation undertakes the construction of projects whose primary purpose is the reclamation of arid and semiarid lands in the western part of the United States and also markets power in this area outside the boundaries of the Bonneville Power Administration and Southwestern Power Administration. The activities of these agencies are more fully described in sections of this report covering each of the Department's bureaus and offices.

In addition, the Assistant Secretary—Water and Power Development—exercises responsibilities which are not exclusive to any one of the Department's operating bureaus or agencies, but which involve particularly the consideration of problems of a broad, overall, or policy nature. These include the supervision of the saline water conversion program, which is described in a separate chapter in this report, and coordination, review, and preparation of departmental comments on water and power project proposals submitted by other Federal agencies to this Department. During the fiscal year ended June 30, 1955, the Department, through this office, reviewed 35 reports of the Corps of Engineers, Department of the Army, concerned primarily with flood control and navigation; 1 report of the Department of Agriculture concerned primarily with runoff and waterflow retardation; 3 reports of the Public Health Service, Department of Health, Education, and Welfare, concerning water pollution; and 42 applications for permits and licenses under the Federal Power Act.

The Assistant Secretary—Water and Power Development—also exercises, under delegation from the Secretary of the Interior, direct supervision over activities in the field of defense electric power. These activities are fully described in another section of this report.

The Assistant Secretary—Water and Power Development—actively participated in the negotiation of contracts for the marketing of power in the Southeast and Southwest during fiscal year 1955. These negotiations included discussions with the Carolina Power & Light and preferred agencies for a wheeling arrangement to market the remaining one-third of the John H. Kerr project power in the company's service area. Negotiations for contracts to replace inoperative lease operate with option to purchase transmission contracts and power sales and exchange agreements were continued with generating and transmission cooperatives in the SPA area. Interim operating, sales, and purchase contracts were also negotiated with the G and T cooperatives for this year. At the request of the Assistant Secretary, a review of the hydroelectric potential available, as a result of the recent severe drought in the Southwest area, was made by an interagency group of experts representing the Corps of Engineers, Federal Power Commission, and the Department of the Interior.

Policies were reviewed and formulated for the marketing of power and preparation of adjustments in rates by the Southwestern Power Administration. Work was continued with the Bureau of Reclamation on general marketing criteria for guidance in the disposal of power. The following summarizes the power marketing activities of the Department's four marketing agencies:

Power marketing data, fiscal year 1955

Marketing Agency	Installed capacity (as of June 30, 1955) (kilowatts)	Net energy generated (million kilowatt hours)	Energy marketed (million kilowatt hours)	Gross revenue (thousands of dollars)
Bureau of Reclamation.....	¹ 5,208,050	25,643	² 10,455	³ 35,620
Bonneville Power Administration.....	⁴ 1,359,800	8,613	21,823	51,124
Southeastern Power Administration.....	⁴ 1,031,000	2,124	⁵ 2,121	9,783
Southwestern Power Administration.....	⁴ 426,000	584	⁵ 778	4,063
Total.....	8,024,850	36,964	⁵ 35,177	100,590

¹ Includes 325,000 kilowatts at Corps of Engineers' and 31,500 kilowatts in International Water Commission's projects.

² Excludes 14,576 million kilowatt hours delivered at Grand Coulee Dam and Hungry Horse Dam by Bureau of Reclamation to Bonneville Power Administration.

³ Excludes \$16,144,000 revenue received from Bonneville Power Administration.

⁴ Capacity at Corps of Engineers projects.

⁵ Includes purchased energy.

Instructions were developed and issued for a comprehensive analysis and review of the Missouri Basin program in cooperation with the Inter-Agency Committee on Water Resources.

Studies were continued in cooperation with other interested Federal agencies of Canadian-United States reservoir storage and hydro-electric power projects.

The Assistant Secretary participated with representatives of the Department of the Interior and other interested Federal agencies in further discussions with representatives of the State of California on the proposal of the California Water Project Authority for State acquisition of the Central Valley project.

He also served as departmental representative on the Inter-Agency Committee on Water Resources. The purpose of this Committee is to provide for the coordination of policies and programs of the various Federal agencies concerned with water resources development. During the year, the Committee established field committees in the basins of the Columbia, the Missouri, the Pacific Southwest, and the Arkansas-White-Red.

BUREAU OF RECLAMATION

Wilbur A. Dexheimer, *Commissioner*



Introduction

GREATER participation by State governments and local communities, private industries and individual citizens paced the program of the Bureau of Reclamation in the development of the water resources in 17 Western States and Alaska during the fiscal year ending June 30, 1955. Legislation enacted or pending in Congress at the close of the year pointed to an even closer partnership in sharing the costs, responsibilities and benefits of Federal Reclamation in 1956.

A highlight of the year was the dramatic service of the Colorado-Big Thompson project to the extensive irrigated areas in northern Colorado which in 1954 experienced the first serious drought in 20 years. The availability of more than 300,000 acre-feet of water from the virtually completed transmountain diversion project prevented total disaster from a withering drought and assured economic and agricultural stability to a farflung area extending from the Rocky Mountains eastwards through the South Platte River Basin to the Colorado-Nebraska State line. Project water deliveries which brought a gross repayment to the Government of \$770,880, resulted in an increased crop income to the benefited area of not less than \$22 million in that one season.

Increased emphasis was given to cooperative engineering effort with small irrigation districts. There was continued improvement in rehabilitation, reconstruction, and betterment of irrigation projects built many years ago under private initiative. Indicative of this effort were the rehabilitation of irrigation facilities on the Dalton Gardens and Avondale irrigation systems in Idaho; the rehabilitation of the Isleta Diversion Dam and more than 180 miles of drains on the Middle Rio Grande project in New Mexico; and rehabilitation of the Savage Rapids Dam on the Grants Pass project in Oregon.

The Bureau of Reclamation was represented at four international engineering conferences during the year including attendance by the Commissioner at the World Power Conference held in Rio de Janeiro, Brazil, in August 1954, and as an official United States delegate designated by the Department of State at the Fifth International Congress on Large Dams held in Paris, France, in June 1955.

DIVISION OF DESIGN AND CONSTRUCTION

Construction Completed

Construction completed during fiscal year 1955 on Bureau of Reclamation projects in the West and in Alaska provided irrigation facilities to serve about 315,000 acres of land, 133,500 kilowatts of hydroelectric generating capacity, 785 miles of canals, pipelines, laterals, and drains, and more than 470 miles of electrical transmission lines. The investment in this new construction work and in related water resource and land development features totaled \$122 million for the fiscal year.

During the fiscal year 482 separate contracts, having a total face value of about \$46 million, were awarded for construction, materials, equipment, and supplies for Bureau project undertakings. Of this total contract value, construction contracts comprised about \$41 million, or about 89 percent. The 186 construction contracts in progress at the end of the fiscal year had a total value of more than \$145 million.

The 1955 fiscal year saw the completion of the Eklutna project in Alaska and the placing in service of the 30,000-kilowatt Eklutna powerplant; the "holing through" of the 6-mile long Tecolote Tunnel on the Cachuma project in California; completion of the Nimbus Dam and its 13,500-kilowatt powerplant on the Central Valley project in California; and completion of the 36,000-kilowatt Alcova powerplant on the Kendrick project in Wyoming.

Other outstanding construction events were the completion of the Sly Park Dam on the Central Valley project in California; the completion of the 3.3-mile long Gateway Tunnel on the Weber Basin project in Utah; the dedication of the Kirwin Dam on the Missouri River Basin project in Kansas; and the start of construction in the Missouri River Basin of the Glendo Dam in Wyoming and the Lovewell Dam in Kansas.

The 1956 fiscal year construction program will continue work on 34 projects and Missouri River Basin project units and will extend irrigation water service to 120,400 acres of new land, provide supplemental irrigation to 82,900 acres, and generate an additional 120,000 kilowatts of hydroelectric power.

Contract Awards

Table 1 lists the major construction contracts (more than \$1 million) awarded by the Bureau of Reclamation in fiscal year 1955. Among features for which contracts were awarded were Glendo Dam on the Missouri River Basin project in Wyoming, Lovewell Dam on the Missouri River Basin project in Kansas, 7.6 miles of the Gateway Canal on the Weber Basin project in Utah, and 11.4 miles of highway

relocation at the Monticello Reservoir on the Solano project in California.

The principal features completed on Bureau of Reclamation projects in fiscal year 1955 are listed in table 2. The listing includes 1 storage dam, 3 powerplants, 785 miles of canals, pipelines, laterals, and drains, 474 miles of transmission lines, 2 rehabilitated diversion dams, and 189 miles of rehabilitated drains.

TABLE I.—Major Bureau of Reclamation contracts awarded in fiscal year 1955

Feature	Project	Amount of award
Glendo Dam, powerplant foundation, and 7.5 miles of roads.	Missouri River Basin	\$6,270,790
Lovewell Dam	do	2,324,850
7.6 miles of Gateway Canal	Weber Basin	1,948,822
11.4 miles of highway relocation	Solano	1,663,806
201.5 miles of Alcova-Gering and 5.6 miles of Lingle Tap—Lingle 115-kilovolt transmission lines.	Missouri River Basin	1,493,268
40 miles of pipelines for units 2 and 3, Exeter irrigation district, Friant-Kern Canal. ¹	Central Valley	1,376,755
Pineview Dam enlargement and 2¼ miles of highway relocation. ¹	Weber Basin	1,372,172
48.2 miles of laterals, sublaterals, and wasteways and 6.6 miles of pipelines for Potholes East Canal laterals.	Columbia Basin	1,297,368
33 miles of laterals, sublaterals, wasteways and drains and 2.5 miles of pipe siphon for West Canal laterals.	do	1,211,386
26 miles of laterals for unit 2, Wellton distribution system.	Gila	1,168,977
Stringing conductors and overhead ground wires for 130 miles of Big Bend-Huron—Watertown 230-kilovolt transmission line.	Missouri River Basin	1,127,942

¹ Pineview Dam was originally constructed as part of the Ogden River project, Utah.

TABLE 2.—Principal features completed on Bureau of Reclamation projects in fiscal year 1955

Feature	Project	State
Eklutna Tunnel and powerplant	Eklutna	Alaska.
Nimbus Dam and powerplant	Central Valley	California.
Folsom powerplant structure	do	Do.
Sly Park Dam	do	Do.
2,417-foot Camino Tunnel	do	Do.
5.6-mile Camino conduit	do	Do.
39 miles of laterals for Madera Canal distribution system.	do	Do.
10 miles of pipe laterals for Plainview water irrigation distribution system, Delta-Mendota Canal.	do	Do.
123 miles of pipe laterals for Friant-Kern Canal distribution system.	do	Do.
61 miles of pipe laterals	Cachuma	Do.
Savage Rapids Dam rehabilitation	Grants Pass	Oregon.
71 miles of canals and wasteways	Columbia Basin	Washington.
239 miles of laterals	do	Do.
23 miles of pipelines	do	Do.
9 miles of canals for Kennewick division	Yakima	Do.
27 miles of canals	Gila	Arizona.
44 miles Saguaro-Phoenix-Tucson 115-kilovolt transmission line.	Parker-Davis	Do.
29 miles pipeline for San Jacinto-San Vicente aqueduct.	San Diego	California.
3.3-mile Gateway Tunnel	Weber Basin	Utah.
9 miles of canal and laterals	Eden	Wyoming.
189 miles of drain rehabilitation	Middle Rio Grande	New Mexico.
Isleta Diversion Dam rehabilitation	do	Do.
430 miles of 230-kilovolt transmission lines	Missouri River Basin	North Dakota-South Dakota.
20 miles of Toston and Lombard canals and laterals.	do	Montana.
43 miles of canals and laterals, Bostwick division.	do	Nebraska-Kansas.
61 miles of canals, laterals, and drains, Frenchman-Cambridge division.	do	Nebraska.
Alcova powerplant	Kendrick	Wyoming.
21 miles of supply canals	Colorado-Big Thompson	Colorado.

Progress of Construction

Development of the irrigation system for the Columbia Basin project in Washington progressed during the year to the stage that facilities were available to serve 247,000 acres of lands, the system having been extended to serve an additional 61,000 acres in fiscal year 1955. Completed during the year were 333 miles of canals, laterals, and wasteways. The system of main canals neared completion at year's end.

On the Palisades project in Idaho, excellent construction progress was made in placing the earth embankment of the Palisades Dam, following diversion of the Snake River through the dam's outlet tunnels in August 1954. Good progress was also maintained on the 114,000-kilowatt Palisades powerplant.

Construction of the 12,000-kilowatt Chandler power and pumping plant on the Yakima project in Washington moved ahead of schedule to assure placement of the plant in service during the next fiscal year. Excellent progress was also made on the irrigation system to be served by the pumping installation.

On the Central Valley project in California, substantial progress was made on the project's irrigation distribution and power facilities. For the Friant-Kern Canal distribution system, 122 miles of pipe laterals were completed; 39 miles of open laterals were completed for the Madera Canal distribution system, and 10 miles of pipe laterals were constructed for the Plainview water irrigation distribution system on the Delta-Mendota Canal.

Construction on the American River Division of the Central Valley project advanced to the point of completion of the Nimbus Dam and its 13,500-kilowatt powerplant, and the placing in service of the first of three 54,000-kilowatt generating units of the Folsom powerplant. With the installation of the remaining 2 Folsom units during the next fiscal year, Nimbus and Folsom powerplants will increase the project's power capacity by 175,000 kilowatts. Sly Park Dam was completed as well as the 5.6-mile Camino conduit and the half-mile Camino Tunnel.

Also in California, following the installation of improved drainage and ventilation facilities, excavation of the remaining 4,700 feet of the Cachuma project's 6-mile-long Tecolote Tunnel was resumed in July 1954. The tunnel, one of the most difficult Bureau construction undertakings in recent years because of large inflows of hot water and high humidity, was "holed through" in January 1955. At year's end, the placing of the concrete lining continued in the tunnel. Cachuma project work was also noted by completion of 61 miles of pipe laterals for the Carpinteria and Goleta distribution systems.

In southern California, the remaining 29-mile section of the San Jacinto-San Vicente aqueduct was completed ahead of schedule. The entire 61-mile length of this second barrel of the San Diego aqueduct, which was designed and constructed by the Bureau for the Department of the Navy, was turned over for operation by the Metropolitan Water District of Southern California and the San Diego County Water Authority.

Extension of the Wellton-Mohawk and Dome distribution systems and installation of additional pumping units in the 3 Wellton-Mohawk pumping plants comprised the major work on the Gila project in Arizona. Unit 1 of the Dome Canal, 27 miles long, was completed.

Progress of work on the Weber Basin project in Utah was highlighted by completion of the 3.3-mile Gateway Tunnel. Construction of the project's Wanship Dam was ahead of schedule at the end of the fiscal year, and work on the 4-mile Weber aqueduct and on the 7.6-mile Gateway Canal proceeded on schedule.

On the Middle Rio Grande project in New Mexico rehabilitation of the Isleta Diversion Dam and 189 miles of drains was completed and rehabilitation of the El Vado Dam was substantially completed. In the same State, construction contracts for rehabilitation of the Vermejo project were essentially completed.

The comprehensive program for the development of the land and water resources of the Missouri River Basin project progressed at a good rate. Kirwin Dam in Kansas, a large earthfill structure, was essentially completed. Also in Kansas, Webster Dam neared the midway point of completion, and Lovewell Dam was placed under construction. One of the basin project's major new starts of the year was Glendo Dam and the foundation for the 24,000-kilowatt powerplant construction, starting in December 1954, was sustained at a rapid pace throughout the year.

Other major work was completed on the Missouri River Basin project: 430 miles of "backbone" transmission lines which will transmit power from the large powerplants under construction by the Corps of Engineers on the main stem of the Missouri River in North and South Dakota; 20 miles of the Toston and Lombard canals and laterals in Montana; 43 miles of canals and laterals on the Bostwick division in Nebraska and Kansas; and 61 miles of canals, laterals, and drains under the Frenchman-Cambridge division in Nebraska. On the Sargent unit, also in Nebraska, work was started on the Milburn Diversion Dam and Sargent Canal, the first of several irrigation and flood control facilities planned by the Bureau on the lower reaches of the Platte River and its tributaries.

Construction continued on Tiber Dam in Montana, Pactola Dam in South Dakota, and on about 500 miles of major electrical transmis-

sion lines in the Dakotas and about 230 miles of lines in Nebraska.

Alcova powerplant on the Kendrick project in Wyoming was completed, adding 36,000 kilowatts of installed capacity to the Bureau's hydroelectric power system in the Missouri River Basin area.

On the Colorado-Big Thompson project in Colorado, 21 miles of supply canals were completed. The transmountain diversion project's basic facilities were completed last year, except for the authorized Big Thompson powerplant for which construction funds were not available. Work on the South Platte Supply Canal in fiscal year 1956 will complete the final link in the project's water distribution system.

In Alaska, the 4½-mile Eklutna Tunnel was completed on the Eklutna project and the two 15,000-kilowatt generating units in the Eklutna powerplant were placed in full operation, bringing relief to the power-short Anchorage-Palmer area.

The Bureau continued its safety program during the year to prevent personal injuries through the administration and enforcement of modern safety practices and other preventive measures against the hazards of construction work. Indicative of the progress made in reducing the number of accidents in construction operations was the 7-percent reduction of the accident frequency rate below the previous year's rate.

Design Activities and Developments

Designs and specifications for 117 construction contracts were completed during the year. The average cost for these engineering services as related to the overall Bureau of Reclamation construction and rehabilitation program for the 1955 fiscal year was 4.1 percent.

During the year, for the first time in Bureau design undertakings, the technique of full-scale field tests was applied in determining the performance and the most economical design for an earth dam. To obtain necessary data on the settlement changes caused by the loading of the organic silt foundation for the proposed Willard Dam on the Weber Basin project in Utah, a 35-foot-high test embankment containing embedded measuring apparatus was designed and placed under construction on the project.

Considerable design activity centered on the enlargement and rehabilitation of existing dams. Rehabilitation of the spillways and outlet works for many of these structures imposed complex problems not usually encountered in the development of new works and necessitated innovations in design techniques. Typical of such rehabilitation designs were those for enlargement of the Alamogordo Dam spillway, Carlsbad project, New Mexico; enlargement of the Pineview

Dam, Weber Basin project, Utah; repair of the outlet works for Wickiup Dam, Deschutes project, Oregon; and replacement of the Crescent Lake Dam, Crescent Lake Dam project, Oregon.

A significant innovation in the design of fish protective facilities was the development of a system of protective louvered barriers at the intake to the Tracy pumping plant on the Central Valley project in California. Fish from the Sacramento River, seeking the ocean and finding themselves at the intake, will be concentrated at the louvered barriers, and then be transported safely to the lower river.

To assure continued operation of waterway structures subject to icing during severe winter weather, a new method of electrical induction heating of exposed surfaces was incorporated in certain structure designs. The formation of ice, which could render structures or equipment inoperable, is prevented by the heat generated by induction through an embedded electrical conduit.

Improved techniques were developed in analyzing vibrations in structures and equipment and were successfully applied to eliminate objectionable vibration of structures at five powerplants and one pumping plant.

Specification Requirements

To lower the cost of construction and make more efficient use of its engineering forces, the Bureau initiated the procedure of requiring the contractor on major construction work to perform all detailed construction surveys previously carried out by the Government; initial survey layouts and surveys for installation of certain major equipment requiring precise measurement will continue to be made by the Bureau.

Foreign Manufacturers

European manufacturers continued to show active interest in Bureau equipment and materials advertisements. During the year 27 contracts for electrical equipment were awarded to foreign manufacturers or their representatives. These contracts, which included 19 Italian, 5 Austrian, and 3 English contracts, totaled \$961,297. For the first half of the fiscal year, under the "Buy American Act," a differential of 25 percent was added to all foreign bids before comparison was made with domestic bids. However, by Executive Order 10582, dated December 17, 1954, the differential was reduced to either 6 percent or 10 percent depending upon how it was applied. Although the total value of foreign awards was less than fiscal year 1954, the number of contracts awarded in fiscal year 1955 to foreign firms more than doubled over fiscal year 1954.

Research Activities

Investigations in the Bureau's engineering laboratories led to improved economy and serviceability of Reclamation projects.

In the hydraulic laboratory a novel and economical wave suppressor was developed for the Central Valley project's Friant-Kern Canal stilling basin to reduce excessive waves formed during high discharge from the 96-inch valves at Friant Dam. Hydraulic laboratory investigations of alternative preliminary designs to provide additional flood capacity for the Alamogordo Dam spillway indicated that improved hydraulic characteristics in the spillway could be achieved at less construction cost than previously contemplated. Other model studies demonstrated the feasibility of increasing the spillway capacity for the Palo Verde Diversion Dam, a minimum of sediment in water being discharged through the canal headworks. Model studies were completed for the standardization of a weir box for dissipating energy and measuring discharge at turnouts from canals.

Economy in placing earth linings for canals was achieved on several projects as the result of the earth laboratory studies on blending soils to meet impermeability and erosion resistance requirements. Laboratory investigations indicated the possible use of soil cement or an inexpensive concrete or mortar lining as canal lining for the proposed Ainsworth Canal in Nebraska, which will traverse the unstable dune sand area.

In concrete materials investigations acceptance standards were developed for lightweight pumice concrete roof slabs, first use of this type of construction having been applied to the Palisades powerplant. Tests of waterproofing membranes for concrete roof and deck construction indicated that butyl rubber sheeting or prefabricated asphalt board may be an acceptable substitute for tar and felt.

The first phase of research in hydration of portland-pozzolan cements, conducted under a National Science Foundation grant—the first grant the Foundation has made to a Government agency—was completed with the collection of minerals required for the study.

In other areas of research, a survey of 5 types of buried asphalt membrane canal lining in service as long as 6 years confirmed laboratory indications that catalytically blown asphalts processed with phosphorous pentoxide have the best prospects for longest service life. Laboratory tests also showed that the toughness and tenacity of asphalt can be increased significantly by the addition of up to 5 percent of rubber in the liquid form.

During the year 141 laboratory reports were issued embracing the subjects of research and testing of concrete materials, hydraulic laboratory studies, bituminous materials, protective coatings, weed control, and structural studies.

Work Performed for Other Agencies

Throughout the year the Bureau's engineering staff was called upon for numerous advisory and testing services by Federal and other public agencies.

Through the application of high-speed electronic computers and Bureau-developed techniques in the use of the equipment, work was performed for the Upper Colorado River Commission in the forecasting of seasonal runoffs. Assistance was also given the International Boundary and Water Commission in the application of high-speed electronic computers to the Commission's extensive studies of reservoir operations for Falcon Dam and the proposed Diablo Dam. Geologic advisory service was performed for the International Boundary and Water Commission in studies of the foundation problems at the Diablo Dam site.

The Atomic Energy Commission sought advice on the use of geophysical methods in locating uranium ore. Bureau geophysicists and geophysical equipment were provided the Commission for experimental work in the exploration of uranium deposits in the Black Hills area in South Dakota and adjacent areas.

Bureau engineers participated in a conference with Department of the Navy representatives in recommending methods of repairing the cracks in the Navy's 50,000,000-gallon reservoir at Hawthorne, Nev. During the year the Bureau completed its analyses of stress from strain meters embedded in the mass concrete of the city of Seattle's Ross Dam and prepared a comprehensive report on the analyses which had been conducted under a cooperative investigation program between the city of Seattle and the Bureau since 1943. Also, for the city of Seattle, studies of the spillway designs for the Gorge High Dam were carried out in the Bureau's hydraulic laboratory.

Bureau laboratory advisory and technical services were also made available to the Bureau of Indian Affairs in investigations of the concrete in Coolidge Dam, to the International Boundary and Water Commission in its studies of controlling corrosion in the penstocks in both the United States and Mexican powerplants at Falcon Dam, and to the San Diego County Water Authority in hydraulic measurement studies for the San Diego aqueduct.

Construction Costs

Although construction wage rates and material costs increased about 4 percent during fiscal year 1955, Bureau of Reclamation construction costs averaged about 4 percent less than costs experienced during the previous fiscal year. However, construction costs began to increase during the second half of fiscal year 1955, and by June 1955 had risen to about the same level as June 1954. Wage settlements and strikes near the end of the fiscal year, coupled with the record-breaking pace of the construction industry, were expected to force reclamation construction costs on up from the June 1955 level.

Bidding interest in all types of reclamation construction work decreased noticeably from the interest shown in fiscal year 1954, possibly reflecting the tremendous amount of other construction work in progress. The average number of bids per construction schedule, amounting to 8.8 for the second half of fiscal year 1954, dropped to 7.3 for the first half of fiscal year 1955, and to 6.6 for the second half of the fiscal year.

Table 3 shows cost indexes for Bureau of Reclamation construction work based on the combined costs of materials and labor supplied by contractors and materials and labor supplied by the Government.

TABLE 3.—*Bureau of Reclamation construction indexes, fiscal year 1955*

Cost indexes based on January 1940 costs=1.00	July 1954	January 1955	June 1955
Dams:			
Earth.....	2.10	1.96	2.10
Concrete.....	2.15	2.05	2.16
Pumping plants:			
Building and equipment.....	2.55	2.57	2.60
Structures and improvements ¹	2.75	2.75	2.81
Equipment.....	2.35	2.36	2.36
Pumps and prime movers.....	2.45	2.44	2.44
Accessory electric and miscellaneous equipment.....	2.25	2.24	2.24
Discharge pipes.....	2.80	2.88	2.96
Canals and conduits:			
Canals.....	2.40	2.16	2.26
Conduits (tunnels, free flow, concrete lined).....	2.55	2.58	2.62
Laterals and drains.....	2.70	2.78	2.85
Powerplants, hydro:			
Building and equipment.....	2.45	2.48	2.50
Structures and improvements ¹	2.70	2.71	2.78
Equipment.....	2.35	2.34	2.35
Turbines and generators.....	2.40	2.36	2.35
Accessory electrical equipment.....	2.25	2.28	2.29
Miscellaneous equipment.....	2.30	2.34	2.40
Penstocks.....	2.80	2.88	2.96
Transmission switchyards and substations.....	2.55	2.57	2.56
Transmission lines (wood pole 115-kilovolt).....	2.10	2.18	2.06
Transmission lines (steel tower 230-kilovolt).....	2.25	2.29	2.33
Permanent general property: Buildings.....	2.60	2.67	2.71
Roads and bridges:			
Primary roads.....	2.30	2.31	2.33
Secondary roads, unsurfaced.....	2.05	2.04	2.06
Bridges (steel).....	2.75	2.83	2.87
Composite index.....	2.35	2.26	2.36

¹ Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

Drainage and Ground Water Problems

Progressive improvement in the many aspects of the Bureau's drainage and ground-water activities continued during the year. Important advances were made in the analytical approach to the solution of drainage and ground-water problems. Basic theories and new mathematical formulas were derived to assist in predicting drainage problem areas and in forecasting the behavior of ground water after irrigation and the suitability of lands for irrigation. New techniques were also developed for appraising the feasibility of drainage by pumping from ground water in irrigated areas and new formulas were derived for analyzing water movement in "tight" soils. Limited and controlled water applications were studied as a means of reducing drainage requirements or of permitting irrigation of lands which cannot be readily drained.

Progress was also made in the drainage and ground-water phases of operating projects as indicated by the increased cooperative effort by water users on Bureau projects to adequate drainage and construction of new drains on irrigated lands. Several projects constructed drains during the year and one project completely rehabilitated and improved its drainage system, restoring to productivity lands which for many years had been only marginal or entirely unproductive. Other operating projects undertook drainage investigations, the Bureau advising and assisting in technical aspects and in reimbursable financing. Technical studies were made for and counsel was given to water users' organizations and other entities on claims involving alleged damage from ground water resulting from project operation.

Close liaison among Bureau engineers and exchange of information with other Federal agencies and committees of technical organizations made the Bureau's progress in drainage and ground-water developments available to the profession. Bureau engineers also assisted foreign engineers in their drainage and ground-water work, and in turn, gained information on foreign experiences for application to Bureau projects.

TABLE 4.—Bureau of Reclamation Storage Dams, June 30, 1955

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Alaska: Eklutna	Eklutna	Eklutna Creek	Earth dike and concrete buttressed wall weir.	182, 100	26	555	5, 000	1955
Arizona: Salt River	Bartlett	Verde	Concrete multiple-arch	1 179, 500	287	1, 063	182, 000	1939
	Cave Creek	Cave Creek	do	1 179, 500	109	1, 648	18, 775	1923
	Horse Mesa	Salt	Concrete arch, powerplant	1 245, 100	300	803	162, 000	1927
	Mormon Flat	do	do	1 57, 900	224	505	59, 900	1927
	Roosevelt	do	Masonry arch-gravity, powerplant	1 1, 398, 000	280	1, 125	353, 800	1911
	Stewart Mountain	do	Concrete arch, powerplant	69, 800	207	1, 260	120, 500	1930
Arizona-California: Parker-Davis	Parker ²	Colorado	do	717, 000	320	856	380, 000	1938
Arizona-Nevada: Boulder Canyon	Hoover (Boulder)	do	Concrete arch-gravity, 2 powerplants.	31, 142, 000	726	1, 244	4, 400, 000	1936
California: Parker-Davis	Davis	do	Earth, powerplant	1, 820, 000	200	1, 600	4, 357, 500	1950
	Cachuma	Santa Ynez	Earth	232, 000	275	2, 975	6, 600, 000	1953
	Glen Anne	Offstream	do	500	102	240	121, 000	1953
Central Valley	Lauro	do	do	642	110	540	472, 000	1952
	Folsom	American ³	Concrete gravity, embankment wings, powerplant.	1, 000, 000	340	1, 400	1, 450, 000	(⁴)
	Friant ²	San Joaquin	Concrete gravity	521, 000	319	3, 488	2, 135, 000	1942
Orland	Keswick ⁵	Sacramento	do	23, 800	159	1, 046	197, 000	1945
	Martinez	Offstream	Earth	7, 600	38	1, 200	183, 450	1947
	Nimbus	American	Earth, concrete overflow section	4, 493, 000	76	1, 093	205, 000	1955
	Shasta	Sacramento	Concrete curved-gravity, embankment wing, powerplant.	47, 130	602	3, 460	6, 541, 000	1945
	Sly Park	Sly Park Creek	Earth, rock	51, 000	190	760	657, 000	1955
	East Park	Little Stony Creek	Concrete arch-gravity	150, 200	139	226	15, 745	1910
Solano	Stony Gorge	Stony Creek	Concrete slab-and-buttress	1, 600, 000	139	868	43, 100	1928
Colorado:	Monticello	Putah Creek	Concrete arch	1, 600, 000	295	1, 000	270, 000	(⁴)
Colorado-Big Thompson	Carter Lake	Offstream	Earth (2 dikes)	117, 000	200	1, 235	2, 900, 000	1952
	Dixon Canyon	do	Earth	(⁶)	240	1, 215	3, 004, 000	1949
	Granby	do	do	19, 000	70	730	3, 364, 500	1949
	Green Mountain	Colorado	do	546, 000	245	885	2, 901, 300	1950
	Horseshoe	Blue	Earth, powerplant	154, 600	300	1, 160	4, 400, 000	1943
	Marys Lake ⁴	Offstream	do	147, 000	150	1, 610	1, 890, 000	1949
	Olympus ²	do	Earth (2 dikes), powerplant	147, 700	40	1, 300	60, 300	1950
	Rattlesnake	Big Thompson	Concrete gravity, embankment wing	2, 850	60	1, 850	300, 000	1949
	Shadow Mountain	Offstream	Earth	2, 000	105	1, 080	408, 000	1952
	Soldier Canyon	Colorado	do	16, 000	44	600	210, 000	1946
	Spring Canyon	do	do	(⁶)	220	1, 420	3, 288, 000	1949
	Willow Creek	do	do	11, 150	215	1, 115	2, 213, 000	1948
	Fruitgrowers	Willow Creek	do	1, 150	135	1, 075	384, 000	1953
	Mancos	Alfalfa Run	do	4, 600	65	1, 520	135, 500	1938
	Jackson Gulch	Offstream	do	10, 000	181	1, 895	1, 988, 000	1948

Pine River.....	Vallecito.....	Pine.....	do.....	129,700	162	4,010	3,738,000	1947
Uncompahgre.....	Taylor Park.....	Taylor.....	do.....	106,200	206	1,675	1,115,100	1931
San Luis Valley.....	Platoro.....	Conejos.....	do.....	60,000	165	1,538	9,909,884	1932
Idaho-Oregon: Boise.....	Anderson Ranch.....	Boise, South Fork.....	Earth, powerplant.....	493,200	456	1,350	9,653,300	1950
	Arrowrock.....	Boise.....	Concrete arch-gravity.....	1,280,600	354	1,150	636,000	1915
	Cascade.....	Payette, North Fork.....	Earth.....	704,100	107	785	395,400	1948
	Deadwood.....	Deadwood.....	Concrete arch.....	1,161,900	165	749	36,400	1931
	Deer Flat, Upper.....	Deer Flat, Upper.....	Earth.....	74	74	4,000	1,245,000	1908
	Deer Flat, Lower.....	do.....	do.....	46	46	7,200	1,246,000	1908
	Deer Flat, Middle.....	do.....	do.....	16	16	950	22,500	1908
Idaho-Wyoming:								
Minidoka.....	American Falls.....	Snake.....	Concrete gravity, embankment wings.....	1,700,000	94	5,227	313,600	1927
	Jackson Lake.....	do.....	do.....	1,847,000	70	4,920	491,700	1911
	Minidoka 2.....	do.....	Earth with concrete, powerhouse section, powerplant.....	195,200	86	4,475	257,300	1906
Palisades.....	Grassy Lake.....	Grassy Lake.....	Earth.....	15,200	118	1,170	541,600	1939
	Island Park.....	Snake, Henry's Fork.....	do.....	127,200	91	9,448	464,000	1938
	Palisades.....	South Fork, Snake River.....	do.....	1,400,000	230	2,100	13,571,000	(4)
Kansas:								
Bostwick division (Missouri River Basin).	Lovevell.....	White Rock Creek.....	Earth (1 dike).....	94,000	66	8,500	3,121,700	(4)
Smoky Hill division (Missouri River Basin).	Cedar Bluff.....	Smoky Hill.....	do.....	368,100	204	11,000	8,917,000	1951
Kansas-Colorado:								
Solomon division (Missouri River Basin).	Kirwin.....	North Fork, Solomon River.....	do.....	315,000	170	12,600	9,180,000	1955
St. Francis (Missouri River Basin).	Webster.....	Solomon River.....	Earth, rock.....	(4)	108	10,600	5,500,000	(4)
Montana:	Bonny.....	South Fork, Republican River.....	do.....	175,000	160	9,265	8,530,000	1951
Butter Root.....	Como.....	Rock Creek.....	do.....	34,800	65	2,550	1,106,000	1910
Hungry Horse.....	Hungry Horse.....	Flathead, South Fork.....	Concrete arch-gravity, powerplant.....	3,468,000	564	2,115	3,086,200	1952
Huntley.....	Anita.....	Ofstream.....	Earth.....	1,400	42	1,050	142,800	1937
Milk River.....	Fresno.....	Milk.....	do.....	129,100	111	2,070	2,105,000	1939
	Nelson.....	Ofstream.....	Earth (5 dikes).....	85,500	28	9,900	232,600	1915
	Sherburne Lakes.....	Swiftcurrent Creek.....	Earth.....	166,100	96	1,086	227,600	1921
Sun River.....	Gibson.....	Sun, North Fork.....	Concrete arch.....	1,105,500	196	960	167,500	1929
	Pishkun.....	Ofstream.....	Earth (8 dikes).....	46,400	50	9,180	599,300	1921
	Willow Creek.....	Willow Creek.....	Earth, semihydraulic fill.....	132,400	93	650	254,186	1911
	Canyon Ferry.....	Missouri River.....	Concrete gravity.....	2,050,000	220	1,010	414,700	1954
Helena-Great Falls division (Missouri River Basin).	Tiber.....	do.....	Earth, rock.....	1,397,000	205	4,300	5,375,000	(4)
Lower Marias division (Missouri River Basin).								

See footnotes at end of table.

TABLE 4.—Bureau of Reclamation Storage Dams, June 30, 1955—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Nebraska: Frenchman-Cambridge division (Missouri River Basin). Mirage Flats. Nebraska-Wyoming: North Platte.	Enders	Frenchman Creek	Earth	74,000	134	2,603	1,951,000	1950
	Medicine Creek	Medicine Creek	do	93,000	180	5,630	2,883,000	1950
	Trenton	Republican	do	172,000	95	7,800	8,130,000	1954
	Box Butte	Niobrara	do	31,300	87	5,508	1,422,000	1946
	Guernsey	North Platte	Earth, powerplant	48,100	135	560	586,200	1927
	Lake Alice, upper	Offstream	Earth	11,400	30	3,100	240,600	1913
Nevada: Humboldt. Newlands.	Lake Alice, lower	do	do	11,400	23	2,550	119,000	1912
	Minatere	do	do	160,800	63	3,700	696,100	1915
	Pathfinder	North Platte	Masonry arch-gravity	1,070,000	214	1,070	65,700	1909
	Pathfinder dike	do	Earth	1,179,000	38	1,650	152,200	1909
	Rye Patch	Humboldt	Earth	1,070,000	80	914	356,300	1936
	Lake Tahoe ²	Carson	Earth, powerplant	1,273,600	162	5,400	733,100	1915
Nevada-California: Truckee Storage. New Mexico: Carlsbad.	Boca	Truckee	Concrete slab-and-buttress, lake outlet regulator.	1,732,000	16	109	733,430	1913
		Little Truckee	Earth	41,200	116	1,629	911,900	1939
	Alamogordo	Pecos	Earth and rockfill	156,800	148	3,084	1,914,900	1937
	Avalon ²	do	Earth	7,000	58	1,025	202,300	1891
	McMillan	do	do	38,700	57	2,114	234,000	1894
	El Vado	Rio Chama	Earth—Steel membrane on up- stream face.	200,300	175	1,300	607,802	(^c)
Middle Rio Grande.	Picacho South	Picacho Arroyo, South Branch.	do	8400	29	1,620	91,000	1954
	Picacho North	Picacho Arroyo, North Branch.	do	8565	45	1,600	149,000	1953
	Dam No. 2	Offstream	do	2,900	16	10,700	206,000	1954
	Dam No. 13	do	do	5,000	32	8,200	248,000	1954
	Stubblefield (1 dike)	do	do	16,000	47	15,700	827,000	1954
	Caballo ²	Rio Grande	do	340,850	112	4,558	1,244,200	1938
New Mexico-Texas: Rio Grande.	Elephant Butte	do	Concrete gravity, powerplant. (1940).	1,218,400	301	1,674	629,500	1916
North Dakota: Heart division (Missouri River Basin).	Heart Butte	Heart River	Earth	450,000	174	1,850	1,222,000	1949
	Dickinson	do	do	16,500	69	2,225	326,000	1950
	Jamestown	James	do	1,460	100	1,400	960,000	1953
	Altus ²	Red, North Fork	Concrete gravity, masonry-faced	1151,700	110	1,112	70,200	1945
	Thief Valley	Powder	Concrete slab-and-buttress	17,400	70	390	6,288	1932
	Unity	Burnt	Earth, rock-faced	25,800	83	675	253,600	1938

Deschutes.....	Deschutes.....	Earth.....	55,300	36	285	29,700	1940
Ochoco Creek.....	Ochoco Creek.....	do.....	47,500	125	1,350	760,000	9 1921
Deschutes.....	Deschutes.....	do.....	187,300	100	13,860	1,852,000	{ 1949
Wickiup.....	Wickiup.....	do.....	150,000	98	3,420	703,400	{ 1948
Wickiup-East Dike.....	Wickiup-East Dike.....	do.....	173,800	117	2,700	2,363,800	1927
Cold Springs.....	Cold Springs.....	Earth, concrete-faced.....	69,900	180	1,860	648,300	1936
McKay Creek.....	McKay Creek.....	Earth.....	192,400	110	3,840	19,500	1919
Agency Valley.....	Agency Valley.....	Concrete arch.....	527,000	106	840	63,400	1910
Warm Springs.....	Warm Springs.....	Earth.....	194,300	39	485	11,900	1925
Clear Lake.....	Clear Lake.....	Concrete arch.....	1 873,000	88	435	2,200	1921
Gerber.....	Gerber.....	Concrete slab-and-buttress, lake outlet regulator.....	1,120,000	22	883	537,500	1932
Link River.....	Link River.....	Concrete arch-gravity.....	220,000	417	1,900	749,600	1949
Owyhee ?.....	Owyhee ?.....	Concrete gravity, embankment wing.....	99,000	230	1,340	2,400,000	(4)
Angostura.....	Angostura.....	Earth, rock.....	1 177,500	122	6,262	1,783,200	1911
Belle Fourche.....	Belle Fourche.....	Earth, concrete-faced.....	15,700	133	825	607,400	1947
Rapid Valley.....	Rapid Valley.....	Earth.....	467,000	145	1,900	3,500,000	1951
Deerfield.....	Deerfield.....	do.....	1,951,300	278	5,063	3,579,000	1942
Grand division (Missouri River Basin).....	Grand division (Missouri River Basin).....	Concrete gravity, embankment wings, powerplant.....	18,800	116	540	435,000	1935
Texas: Colorado River.....	Colorado (Texas).....	Earth.....	5,800	54	663	138,900	1937
Utah:	Utah:	do.....	1 35,800	110	1,108	513,100	1938
Hyrum.....	Hyrum.....	do.....	5,500	101	4,781	410,000	1946
Moon Lake.....	Moon Lake.....	do.....	43,600	103	480	267,700	1937
Newton.....	Newton.....	do.....	152,600	233	1,304	2,827,000	1941
Ogden River.....	Ogden River.....	do.....	73,000	125	575	202,700	1946
Pine View.....	Pine View.....	do.....	283,000	79	488	117,000	1913
Provo Creek.....	Provo Creek.....	do.....	60,000	170	2,000	3,021,000	(4)
Scoried.....	Scoried.....	do.....	73,900	158	1,887	1,538,800	1931
Strawberry Valley.....	Strawberry Valley.....	do.....	9,402,000	550	4,173	10,585,000	1942
Weber Basin.....	Weber Basin.....	Concrete gravity, 2 powerplants and pumping plant.....	1,275,000	94	9,800	1,605,000	1949
Weber River.....	Weber River.....	Earth.....	65,000	150	1,450	1,471,500	1951
Echo.....	Echo.....	do.....	10 675,000	130	1,900	1,462,000	1948
Grand Coulee.....	Grand Coulee.....	do.....	1 13,000	200	19,000	8,753,000	1949
Dry Falls.....	Dry Falls.....	Earth, hydraulic fill.....	1 10,500	70	1,000	359,000	1921
North.....	North.....	Earth.....	2 33,700	42	1,260	194,900	1910
Long Lake.....	Long Lake.....	do.....	2 5,300	45	3,660	252,600	1910
O'Sullivan.....	O'Sullivan.....	Concrete arch.....	436,900	80	404	5,800	1914
Conconully.....	Conconully.....	Earth.....	1 239,000	135	750	1,411,300	1933
Salmon Lake.....	Salmon Lake.....	do.....	157,800	114	1,400	199,600	1912
Bumping Lake.....	Bumping Lake.....	do.....	1 198,000	105	6,550	683,500	1917
Clear Creek.....	Clear Creek.....	Earth, semihydraulic fill.....	1 198,000	235	920	2,048,600	1925
Cle Elum.....	Cle Elum.....	do.....					
Kachess.....	Kachess.....	do.....					
Keechelus.....	Keechelus.....	do.....					
Tieton.....	Tieton.....	do.....					

See footnotes at end of table.

TABLE 4.—Bureau of Reclamation Storage Dams, June 30, 1955—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Wyoming:								
Boysen division (Missouri River Basin).	Boysen	Big Horn	Earth, powerplant	1,493,000	220	1,000	1,689,000	1952
Cheyenne division (Missouri River Basin).	Keyhole	Belle Fourche	Earth	510,000	165	3,420	1,300,000	1952
Eden	Big Sandy	Big Sandy Creek	do	65,000	80	2,300	840,000	1952
Kendrick	Alcova ²	North Platte	do	190,700	265	763	1,635,300	1938
	Seminole	do	Concrete arch, powerplant	1,026,000	295	530	210,200	1939
Oregon Trail division (Missouri River Basin).	Glendo	do	Earth (3 dikes)	800,000	207	4,465	3,021,300	(1)
Riverton	Kortes ³	do	Concrete gravity, powerplant	4,800	240	440	147,000	1951
	Bull Lake	Bull Lake Creek	Earth	1152,000	81	3,456	819,600	1938
	Pilot Butte	Offstream	Earth, semihydraulic fill	131,600	51	1,300	135,300	1926
Wyoming-Montana: Shoshone.	Deaver	do	Earth	680	14	1,300	30,300	1918
	Ralston	do	do	1,500	35	2,200	24,700	1908
	Buffalo Bill	Shoshone	Concrete arch, powerplant	456,600	325	200	82,900	1910

¹ Live storage—dead storage not evaluated.² Storage and diversion.³ Under construction by U. S. Corps of Engineers. Bureau of Reclamation will operate reservoir after completion.⁴ Under construction.⁵ Power dam—water supply for generation of power.⁶ Horsetooth Reservoir formed by 4 dams.⁷ Nonreclamation construction. Rehabilitated by U. S. B. R. in 1955.⁸ For flood retention only.⁹ Rehabilitated by the Bureau of Reclamation in 1950.¹⁰ Majority of active storage behind O'Sullivan Dam provided through wasteways from primary irrigation features of projects.

DEFINITIONS

Capacity: Acre-feet of reservoir storage provided by highest controlled water surface.

Height: Feet between lowest point in foundation and normal crest of dam.

Length: Feet of barrier in dam and integral features constructed between natural abutments.

Volume: Cubic yards of all material in dam and its appurtenant features.

Year: Date original construction was completed. (Other tabular data include supplemental construction.)

TABLE 4A—Bureau of Reclamation diversion dams, June 30, 1955

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Arizona: Salt River	Granite Reef	Salt	Concrete weir	3,600	18	1,128	35,000	1908
	Joint Head	do	Concrete weir, embankment wing	200	4	2,600	5,400	1914
	Power Canal	do	do	220	8	862	16,000	1906
Arizona-California: Gila and Boulder Canyon, All-American Canal system.	Imperial	Colorado	Concrete slab-and-buttress weir, desilting works.	17,160	23	3,475	196,790	1938
Yuma	Laguna	do	Rockfill weir, concrete-surfaced	1,950	10	4,780	486,800	1909
California: Orland	East Park Feed Canal	Stony Creek	Concrete arch, overflow	200	28	271	1,777	1914
	Northside	do	Concrete weir, removable crest	80	3	370	270	1913
	Southside	do	Concrete weir	140	3	895	3,600	1916
	Camp Creek	Camp Creek	Concrete, overflow weir	500	20	143	3,000	1953
Central Valley								
Colorado: Fruitgrowers Dam	Dry Creek	Dry Creek	Concrete weir	100	5	36	242	1940
	Grand Valley	Colorado	Concrete weir, movable crest	1,425	14	543	17,900	1916
	East Canal	Uncompahgre	Concrete weir, embankment wing	330	8	764	1,000	1915
	Garnet	do	Rockfill weir, concrete-surfaced	50	4	75	500	(2)
	Gunnison	Gunnison	Timber-crib weir, concrete wings, removable crest.	1,000	10	244	3,200	1912
	Ironstone	Uncompahgre	Concrete gate-structure, timber-crib wing.	350	8	131	155	(2)
	Loutsenhizer	do	Timber weir	290	9	114	400	2 1883
	Montrose and Delta	do	Concrete gate-structure, movable crest.	450	12	68	500	2 1883
	Selig	do	Timber weir, removable crest	300	10	96	500	(2)
Colorado-Big Thompson.	North Poudre	Cadie la Poudre	Concrete weir, embankment wing	250	18.5	200	8,700	1952
Idaho: Lewiston Orchards.	Sweetwater	Sweetwater Creek	Rockfill weir, concrete diaphragm	77	8	80	400	1948
	Webb Creek	Webb Creek	do	20	10	75	600	1948
	Black Canyon	Payette	Concrete gravity, overflow, removable crest, powerplant.	1,360	111	1,039	81,204	1925
Idaho-Oregon: Boise	Boise River	Boise	Concrete and masonry weir, removable crest, powerplant.	2,815	39	500	26,100	1908
	Cascade Creek	Cascade Creek	Timber-crib weir, removable crest	220	6	217	3,068	1937
	Cross Out	Henry's Fork	Concrete weir	590	10	457	7,375	1937
Idaho-Wyoming: Minidoka.	Rock Creek	Rock Creek	Timber-crib weir	320	6	30	150	2 1910
Montana: Bitter Root.	Frenchtown	Missoula	Earth (includes 3 dikes), nonoverflow.	170	13	489	12,176	1936
Frenchtown								
Huntley	Yellowstone River	Yellowstone	Concrete weir	400	8	250	1,674	1934
Milk River	Dodson	Milk	Timber-crib weir, removable crest, embankment wings.	1,450	22	8,154	87,355	1910
	Saint Mary	St. Mary	Concrete weir	530	6	198	1,230	1915
	Swift Current	Swift Current Creek	Earth, timber-crib core, nonoverflow.	-----	13	4,800	98,400	1915
	Vandala	Milk	Concrete slab-and-buttress weir, movable crest, embankment wing.	250	32	2,350	15,207	1917
Sun River	Sun River	Sun, North Fork	Concrete arch, overflow	1,400	114	261	6,466	1915

See footnotes at end of table.

TABLE 4A—Bureau of Reclamation diversion dams, June 30, 1955—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
Montana-North Dakota: Lower Yellowstone.	Lower Yellowstone.....	Yellowstone.....	Timber-crib weir, embankment wings.	840	4	800	22,500	1910
Nebraska: Bostwick division (MRB).	Superior-Courtland.....	Republican.....	Concrete ogee weir, embankment wings.	169	21	8,075	178,000	1950
Mirage Flats.	Dunlap.....	Niobrara.....	Concrete weir, embankment wing	220	6	577	5,100	1945
Frenchman-Cambridge (MRB).	Cambridge.....	Republican.....	do.....	325	33	432	13,850	1948
Middle Loup division (MRB).	Bartley.....	do.....	do.....	130	35	1,015	58,000	1954
Nebraska-Wyoming: North Platte.	Milburn.....	Middle Loup.....	Concrete weir, embankment.....	260	12	76	1,700	(4)
	Dry Spotted Tail Creek.	Dry Spotted Tail Creek.	Sheet steel pile and earth.	-----	13	255	650	1954
	Horse Creek.....	Horse Creek.....	Concrete weir, embankment wing.	430	6	720	5,280	1923
	Tub Springs Creek.....	Tub Springs Creek.....	Sheet steel pile and earth.	-----	9	205	-----	1954
	Whalen.....	North Platte.....	Concrete weir, embankment wing.	3,700	11	11	81,700	1909
Nevada: Newlands.....	Carson River.....	Carson.....	Concrete gate-structure.	1,950	14	241	2,707	1905
	Derby.....	Truckee.....	Concrete gate-structure, embankment wing.	1,500	15	1,331	36,572	1905
New Mexico: Fort Sumner.....	Fort Sumner.....	Pecos.....	Concrete weir.....	100	35	715	24,660	1951
Middle Rio Grande.	Isleta.....	Rio Grande.....	Concrete gate-structure.	1,051	5	674	2,823	1935
	Vermejo.....	Vermejo.....	Concrete weir, overflow, embankment wing.	600	5	1,021	4,428	1910
New Mexico-Texas: Rio Grande.	American ?.....	Rio Grande.....	Concrete weir, movable crest, embankment wings.	1,110	5	9,306	67,667	1938
	Leasburg.....	do.....	Concrete weir, embankment wing.	600	6	2,865	22,500	1908
	Messilla.....	do.....	do.....	890	4	3,445	23,600	1916
	Pecos.....	do.....	Concrete weir, movable crest, embankment wings.	350	9	2,720	43,238	1917
	Pereha Arroyo.....	Pereha Arroyo.....	Concrete weir, movable crest, embankment wings.	30,000	19	2,489	192,884	1939
	Riverside.....	Rio Grande.....	Concrete weir, movable crest, embankment wings.	1,000	6	3,370	145,150	1928
Oregon: Deschutes.....	North Canal.....	Deschutes.....	Concrete arch-gravity, overflow.	1,000	28	233	4,900	1912
Grants Pass.	Savage Rapids.....	Rogue.....	Concrete, gravity and multiple arch.	207	40	392	5,600	1921
Umatilla.....	Feed Canal.....	Umatilla.....	Concrete weir, embankment wing.	350	4	2,100	14,100	1907
	Maxwell.....	do.....	Concrete and timber-crib weir, embankment wing.	140	5	400	464	1915
	Three Mile Falls.	do.....	Concrete multiple-arch, overflow.	360	23	915	5,068	1914
Vale.....	Harper.....	Malheur.....	Concrete gate-structure, embankment wing.	660	21	914	9,258	1929
Oregon-California: Klamath.	Lost River.....	Lost.....	Concrete multiple-arch, overflow, embankment wings.	1,200	26	675	19,915	1912
	Lower Lost River.....	do.....	Concrete slab-and-buttress.	810	12	324	689	1921
	Malone.....	do.....	Concrete gate-structure, embankment wing.	-----	18	515	24,600	1923

	Miller	Miller Creek	Concrete weir, removable crest, embankment wings.	5	290	1, 615	1924
South Dakota: Belle Fourche.	Belle Fourche	Belle Fourche	Concrete weir, embankment wing	18	2, 523	35, 700	1907
Utah:							
Hyrum	Hyrum	Little Bear, East Fork.	Rockfill weir, embankment wing	1	520	2, 900	1937
Moon Lake	Duchesne Feeder Canal	Duchesne	Concrete weir, embankment wings	6	1 220	4, 000	1939
Provo River	Murdoek	Provo	Concrete weir, overflow, embankment wing.	10	100	9, 036	1950
Strawberry Valley	Weber River	Weber	Concrete weir, embankment wings.	10	1, 795	15, 400	1931
	Indian Creek Crossing	Indian Creek	Concrete weir	9	1, 350	15, 200	1913
	Spanish Fork	Spanish Fork	do	13	74	1, 300	1908
Washington:							
Okanogan	Salmon Creek	Salmon Creek	Concrete weir, embankment wing	5	130	800	1909
Yakima	Easton ¹	Yakima	Concrete gravity, overflow, movable crest.	51	248	5, 760	1929
	Prosser ¹⁰	do	Concrete weir	6	768	1, 026	1904
	Roza	do	Concrete weir, movable crest	34	486	21, 711	1939
	Sunnyside	do	Concrete weir, embankment wing	6	1 500	1, 809	1907
	Tieton	Tieton	do	2	510	1, 368	1908
Wyoming:							
Riverton	Wind River	Wind River	do	19	2, 464	123, 800	1923
Shoshone	Corbett	Shoshone	Concrete slab-and-buttress weir, embankment wing.	12	938	10, 200	1908
	Willwood	do	Concrete gravity, overflow, embankment wing.	41	476	22, 119	1924

¹ Overflow—length of overflow section only.² Nonreclamation construction.³ Storage and diversion—dam classified according to its principal feature.⁴ Under construction.⁵ Nonreclamation construction. Rehabilitated by the Bureau of Reclamation in 1955.⁶ Reconstructed by the Bureau of Reclamation in 1954.⁷ Contributory dam—nonreclamation, furnishing water supply or power for irrigation of Bureau of Reclamation projects.⁸ Dam—indicates data applicable to dam only.⁹ Rehabilitated by the Bureau of Reclamation in 1953.¹⁰ Power dam—water supply for generation of power.

DEFINITIONS

Capacity: Second-foot of diversion provided by canal headworks at dam.

Height: Feet between original streambed and highest controlled water surface.

Length: Feet of barrier in dam and integral features constructed between natural abutments.

Volume: Cubic yards of all material in dam and its appurtenant features.

Year: Date original construction was completed.

DIVISION OF GENERAL ENGINEERING

The Division of General Engineering, formerly the office of the Assistant to the Commissioner—Engineering, was established in 1954 as a staff office in Washington, responsible for coordination and liaison activities on engineering matters requiring the attention of the Commissioner.

Throughout the 1955 fiscal year, coordination and liaison was maintained with the Department of Labor, the Renegotiation Board, General Accounting Office, and the Department on interpretation and clarification of regulations and policies relating to contract actions. Coordination of contract awards was provided in the Commissioner's office and departmental clearance obtained before award of contracts in excess of \$10,000. Two staff members of the Division of General Engineering were designated as alternate members of the Department's Board of Contract Appeals and also to render technical advice and counsel to the Board.

An index-type escalator clause for inclusion in reclamation contracts was developed which is agreeable to the electric equipment industry and other governmental contracting agencies. As a result, index-type escalation clauses based on special indexes compiled and computed by Bureau of Labor Statistics are now available for use in contracts covering several categories of electrical equipment.

New procedures were established and instructions issued to insure compliance by reclamation contractors with the revised nondiscrimination provisions approved by Executive Order 10557, dated September 3, 1954. The Chief of the Division of General Engineering was designated compliance officer for the Bureau to carry out the objectives of the Executive order and maintain liaison with the Department's compliance officer and the President's Committee on Government Contracts.

Plans were formulated for the protection of Bureau structures and facilities under the national security program, and other civil defense work prepared in cooperation with the Department.

Liaison activities with other agencies resulted in the formation of a joint interagency committee for studying the land-subsidence problems in the San Joaquin Valley, Calif. As a result, the Geological Survey, the Coast and Geodetic Survey, Bureau of Mines, Bureau of Reclamation, State of California, Stanford University, and the University of California are cooperating in an investigation program.

DIVISION OF FOREIGN ACTIVITIES

During fiscal year 1955, the Bureau of Reclamation continued to cooperate in the technical-assistance programs of the United States Government, primarily at the request of the Foreign Operations Administration, which took over the work formerly performed by Technical Cooperation Administration and Mutual Security Agency.

The Division of Foreign Activities was established in December 1953 to administer the Bureau's participation in these programs formerly handled by a unit in the Commissioner's office. This assistance consisted of the training of technicians from foreign lands, rendering service to observers and visitors, sending of individual specialists and missions of Bureau technicians to other countries, and the performing at the Reclamation Engineering Center in Denver of technical services, such as testing, research, and design and specification review for foreign water resources development. Besides the work for the Foreign Operations Administration, the Bureau also handled a number of requests for assistance from the Department of State, UNRWA, IBRD, and other agencies directly concerned with water-resources development throughout the world. The Department of State requests were under the authority of Public Law 402 and financed by funds made available by the requesting government.

The Training Administration Branch handled 103 in-service trainees during fiscal year 1955, including engineers and government officials from 21 different countries. Also accommodated were 55 official observers and some 37 accredited visitors from 24 countries.

At the close of the fiscal year, there were 43 people on reclamation rolls on overseas assignments to Costa Rica, Egypt, Ethiopia, Formosa, India, Iran, Iraq, Israel, Lebanon, Pakistan, and Turkey.

During the year the Bureau of Reclamation received \$2,726,480 from various agencies for financing these technical assistance and training programs, as compared to \$2,329,000 for fiscal year 1953 and \$2,438,000 for fiscal year 1954.

DIVISION OF IRRIGATION

The Division of Irrigation is responsible for supervising facilities capable of delivering irrigation water to more than 7 million acres of land, on which approximately 125,000 family-size farms and more than 125,000 suburban units have been developed. The area for which water can be supplied from Bureau-constructed works comprises about one-fourth of the total irrigated land area of the Western United

States. Approximately 1,600,000 persons, who are directly dependent on these reclamation developments, live in project towns and villages.

The Bureau of Reclamation also provides municipal and industrial water service from Bureau-constructed works to over 2,000,000 people.

In addition to water delivery, the Division of Irrigation is responsible, through proper supervision, for protection of the Federal investment in constructed works by keeping project facilities in repair to assure good service and the economical use of water. These facilities include 126 storage and 80 diversion dams, more than 19,500 miles of canals and laterals, over 5,700 miles of drains, 386 pumping plants, and an estimated 11,300 miles of operating roads.

Extension of Irrigation Service

During 1954, Bureau-constructed facilities were extended to about 103,000 irrigable acres of new land within the service area of Reclamation projects. The bulk of this acreage comes from continued progress on the Columbia Basin project, in central Washington State, where facilities were completed to serve approximately 55,000 acres. Significant progress was made on new acreage development in Arizona, California, Idaho, Kansas, Nebraska, South Dakota, and Montana.

Of the above total, 72,018 acres represent land in private ownership on the Gila, Central Valley, and Columbia Basin projects, the Coachella division of the All-American Canal system, the Bostwick and Frenchman-Cambridge divisions, and the Angostura and Crow Creek pump units of the Missouri River Basin project. The remaining 30,056 acres embrace public land from units selected under the settlement program on the Gila, Minidoka, and Columbia Basin projects, and the Coachella division of the All-American Canal system.

Crop Production

The 1954 crop production on irrigated lands within the service area of Federal Reclamation projects was valued at \$865,025,682. This is the second highest year in Reclamation history and is exceeded only by the record production of 1952. The value of crops harvested on Federal reclamation projects was \$79.1 million greater than the previous year and only \$70.7 million less than in 1952. Also, 1954 was the fourth consecutive year in which the total crop value exceeded the three-quarters-billion-dollar mark, increasing the cumulative value of all reclamation harvests through 1954 to about \$10.6 billion.

Total crop production was divided into crop groups on the basis of utility as follows: Cereals, forage, miscellaneous field crops, seeds, vegetables, and fruits and nuts. In terms of acreage, the most significant crop group was forage, with 52 percent of the irrigated lands producing these crops. Cereal crops were the next most important group, followed by field crops, vegetables, fruits and nuts, and seeds, respectively.

In terms of crop value, the most significant crop group was miscellaneous field crops, with production being valued at \$296.4 million. The next most important crop group was forage, followed by vegetables, fruits and nuts, cereals, and seeds. Data on crop production by crop groups follow:

Crop groups	Irrigated crops		Gross crop value	
	Acres	Percent of total	Total	Percent of total
Cereals.....	1,540,672	25	\$99,332,553	12
Forage.....	3,185,677	52	145,412,993	17
Field crops, miscellaneous.....	1,280,641	21	296,366,120	34
Seeds.....	251,790	4	29,597,126	3
Vegetables.....	443,470	7	139,188,063	16
Fruits and nuts.....	254,028	4	133,981,460	16
Soil building, idle, etc.....	119,317	2	121,147,367	2
Total area reported.....	7,075,595	115		
Less residue and multiple crops.....	949,829	15		
Total irrigated.....	6,125,766	100	865,025,682	100

¹ Additional revenues from Federal and commercial agencies.

Forage and cereal crops together, which largely are used locally as supplementary feed for livestock and hence are not in competition on the open market comprise a total of 4,726,349 acres of irrigated land, or over 77 percent of all irrigated lands on Federal Reclamation projects.

Over 700 million acres of rangeland are grazed annually in the Western States. This rangeland potential is seasonal in nature, and can be considered as a national asset only if livestock are available locally to graze these lands. Irrigation farming greatly enhances the value of this great asset by producing livestock feeds which are used during winter months to supplement summer grazing. Without irrigation, much of this great grazing potential would be lost because of prohibitive costs for shipment of cattle into and from these rangeland areas for the summer months.

Irrigated lands on the 69 Federal irrigation projects amounted to 6,125,766 acres in 1954. Significant changes in the irrigated acreage from 1953 occurred on projects where new irrigation development is presently being undertaken, and on projects located in drought areas which have experienced lower than normal precipitation in recent years.

Of the new lands brought within the service area of reclamation projects in 1954, over 65,000 acres were irrigated. The Columbia Basin project had an increase of 40,369 acres in irrigated acreage; Central Valley project, 12,484 acres; Minidoka project-North Side pumping division, 1,752 acres; the Missouri River Basin, 5,979 acres; the Coachella division of the All-American Canal system, 1,822 acres; and the Gila project, about 2,601 acres over 1953.

Projects in some drought areas were unable to furnish irrigation to as large an acreage in 1954, as was the case for 1953. Projects in region 5, which comprises Texas, Eastern New Mexico, Oklahoma, a portion of southern Colorado and Kansas were in this category, as well as other projects located east of the Continental Divide. The Rio Grande project had a decrease in the irrigated acreage of about 22,000 acres; Tucumcari project, 4,500 acres; Carlsbad project, 4,400 acres; North Platte project, 23,800 acres; and the Sun River project, 7,000. However, notwithstanding the fact that drought conditions prevailed in many sections throughout the west, irrigation on reclamation projects increased 28,151 acres over 1953.

Region 1 had a larger acreage of irrigated lands than any of the other regions within the Bureau, and also had the highest gross value of production. Data on irrigated lands and gross crop value are presented by regions as follows:

Regions	Irrigated lands		Gross crop value	
	Acres	Percent of total	Total	Percent of total
1.....	2, 166, 924	35	\$252, 713, 495	29
2.....	846, 800	14	187, 328, 993	22
3.....	885, 983	15	221, 655, 156	26
4.....	556, 712	9	41, 600, 217	5
5.....	258, 163	4	55, 324, 918	6
6.....	444, 755	7	21, 118, 997	2
7.....	966, 429	16	85, 283, 906	10
Total.....	6, 125, 766	100	865, 025, 682	100

The average crop value per acre of irrigated land was \$141.21, an increase over 1953 of over \$12 per acre. The highest average value per acre for all production was attained on the Tieton division of the Yakima project which averaged \$874.89 per irrigated acre in 1954. Fruit and nuts had the highest average value per acre of any of the crop groups (\$527.43) and forage crops were lowest (\$45.65).

The most significant individual crops produced on irrigated project lands from an acreage standpoint were alfalfa, pasture, barley, cotton, sugar beets, wheat, and dry and edible beans. However, from a value standpoint cotton was the most significant crop followed by alfalfa, sugar beets, potatoes, grapes, apples, and beans. These data are as follows:

Crops	Acres	Crop Value	
		Per Acre	Total
Barley.....	574, 770	\$53. 38	\$30, 681, 638
Wheat.....	401, 006	81. 68	32, 754, 864
Alfalfa hay.....	1, 483, 375	66. 78	99, 055, 993
Alfalfa seed.....	109, 406	110. 65	12, 105, 674
Pasture, improved.....	1, 029, 658	29. 93	30, 819, 475
Sugar beets.....	378, 205	176. 85	66, 886, 432
Cotton ¹	513, 878	349. 82	179, 764, 548
Beans, dry.....	351, 230	96. 58	33, 922, 009
Potatoes.....	206, 395	266. 10	54, 922, 434
Tomatoes ²	20, 317	667. 84	13, 568, 513
Lettuce.....	54, 552	396. 33	21, 620, 766
Sweet corn.....	32, 141	215. 41	6, 923, 392
Apples.....	36, 291	936. 07	33, 970, 853
Grapes ³	82, 345	420. 50	34, 626, 082
Citrus fruit.....	43, 051	531. 73	22, 891, 990

¹ Includes value of cottonseed.

² Includes tomatoes for fresh market and canning.

³ Includes grapes of all varieties.

Many foods which are used extensively throughout the country and which receive no price support assistance are produced only in the arid west on irrigated farms. The 17 Western States account for the entire production of almonds, apricots, filberts, walnuts, fresh market fall and winter peas, olives, prunes, mustard seed, dates, figs, raisins, honeyball and honeydew melons, and hops; and produce about 90 per cent of the early spring asparagus, lettuce, early cantaloupes, winter spinach, spring onions, pears, sweet cherries, and grapes.

The acreage and value of crops produced on each of the Federal Reclamation projects are shown in tables 5 and 6.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954*

State, Project, and Subdivision	FULL SUPPLY PROJECTS ¹				SUPPLEMENTAL SUPPLY PROJECTS ²			
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value	
			Total	Per Irrigated Acre			Total	Per Irrigated Acre
REGION 1								
Idaho								
Lewiston Orchards ⁴	Acres 3,523	Acres ⁵ 2,193	\$682,458	\$311.20	Acres	Acres		
Boise:								
Big Bend irrigation district (Oregon)	1,724	1,492	117,829	78.97				
Black Canyon irrigation district, unit 1	6,880	6,370	897,600	140.91				
Black Canyon irrigation district, unit 2	51,705	46,947	2,934,098	62.50				
Boise-Kuna irrigation district	48,660	44,934	3,389,305	75.43				
Nampa and Meridian irrigation district	40,196	35,127	2,520,883	71.76				
New York irrigation district	17,826	14,298	600,251	41.98				
Settlers irrigation district	518	0	0	0				
Wildier irrigation district	56,558	51,088	7,507,604	146.95				
Special and Warren Act contractors								
Total, Boise project	224,067	200,256	17,967,570	89.72				
Idaho-Washington								
Rathdrum Prairie:								
Hayden Lake unit ⁴	1,087	569	49,096	86.28				
Post Falls unit ^{4,5}	3,149	2,705	240,485	88.90				
Total, Rathdrum Prairie project	4,236	3,274	289,581	88.45				
Idaho-Wyoming								
Minidoka:								
American Falls Reservoir district No. 2	98,434	84,505	6,505,622	76.99				
Burley irrigation district	47,937	43,367	3,871,115	89.26				
Fremont-Madison irrigation district					112,000	102,317	\$9,388,884	\$91.76
Minidoka irrigation district	71,882	64,007	5,651,540	88.30				
North Side pumping division	7,289	6,641	555,937	83.71				
Leased and water rental lands								
Special and Warren Act contractors								

Total, Minidoka project.....	225, 442	198, 520	16, 584, 214	83. 54	112, 000	102, 317	9, 388, 884	91. 76
<i>Montana</i>								
Bitter Root ⁴	16, 665	16, 456	543, 106	33. 00				
Frenchtown.....	4, 810	3, 650	167, 823	45. 98				
Missoula Valley ⁴	977	768	18, 080	23. 54				
<i>Oregon</i>								
Arnold ⁴	4, 248	3, 091	307, 298	99. 42	7, 312	7, 305	253, 300	34. 67
Baker.....					15, 230	15, 115	620, 210	41. 03
Burnt River.....								
Deschutes:								
Central Oregon irrigation district ⁴								
Lone Pine irrigation district.....								
North unit.....	50, 000	47, 887	7, 000, 383	146. 19				100. 55
Total, Deschutes project.....	50, 000	47, 887	7, 000, 383	146. 19	46, 739	42, 328	4, 256, 205	100. 55
Grants Pass ⁴	10, 369	7, 226	826, 086	114. 40				
Ochoco ⁴	8, 500	8, 233	765, 190	92. 94				
Umatilla:								
East division.....	10, 911	7, 017	345, 477	49. 23				
South division:								
Stanfield irrigation district ⁴								
Westland irrigation district.....								
West division.....	7, 039	5, 576	371, 955	66. 71				
Total, Umatilla project.....	17, 950	12, 593	717, 432	56. 20	6, 000	5, 129	611, 642	119. 25
Vale.....	32, 000	31, 703	2, 125, 555	67. 05	8, 196	5, 665	299, 973	52. 95
Owyhee:								
Advancement irrigation district.....	700	579	93, 429	161. 36				
Bench irrigation district.....	2, 342	2, 164	564, 958	261. 07				
Crystal irrigation district.....	7, 280	1, 193	260, 451	218. 32				
Gem irrigation district (Idaho).....	33, 454	32, 920	3, 352, 923	101. 85				
Ontario-Nyssa irrigation district.....	5, 831	5, 656	1, 132, 456	260. 22				
Owyhee irrigation district.....	49, 553	47, 506	4, 451, 563	93. 39				
Payette-Oregon Slope irrigation district.....	4, 676	4, 043	926, 397	229. 14				
Ridgeview irrigation district.....	6, 159	6, 059	628, 852	103. 79				
Slide irrigation district.....	1, 144	1, 097	162, 021	147. 69				
Special and Warren Act contractors.....								
Total, Owyhee project.....	105, 139	101, 277	11, 573, 050	114. 27				

See footnotes at end of table.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954—Continued*

State, Project, and Subdivision	FULL SUPPLY PROJECTS ¹				SUPPLEMENTAL SUPPLY PROJECTS ²			
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value	
			Total	Per Irrigated Acre			Total	Per Irrigated Acre
REGION 1—continued								
Washington								
Columbia Basin:	Acres	Acres				Acres		
East Columbia Basin irrigation district.....	74,737	43,364	\$8,024,216	\$185.04				
Quincy-Columbia Basin irrigation district.....	81,346	47,854	6,873,164	143.63				
South Columbia Basin irrigation district.....	31,610	13,109	1,355,348	103.39				
Total, Columbia Basin project.....	187,693	104,327	16,252,728	155.79				
Okanogan.....	5,334	3,680	708,507	192.53				
Yakima:								
Kennewick division.....	4,637	2,386	523,666	219.47				
Kititas division.....	59,610	54,221	2,601,688	47.98				
Roza division.....	72,241	65,001	13,329,084	205.06				
Sunnyside division.....	103,309	79,926	15,345,830	192.00				
Tieton division.....	27,271	24,363	21,314,912	874.89				
Special and Warren Act contractors.....								
Total, Yakima project.....	267,068	225,897	53,115,150	235.13				
Total, region 1.....	1,108,121	971,031	129,644,811	133.51	195,477	177,859	\$15,430,214	\$86.76
REGION 2								
California								
Central Valley ⁷	19,422	17,243	1,510,688	87.61				
Orland.....								
Oregon-California								
Klamath:								
Main division (Oregon).....	839,361	34,007	4,215,831	123.97				
Tule Lake division (California).....	944,430	43,354	5,323,963	122.80				
Special and Warren Act contractors.....								
Leased and water rental lands.....								
Total, Klamath project.....	83,791	77,361	9,539,794	123.32				
Total, region 2.....	103,213	94,604	11,050,482	116.81				

REGION 3									
<i>Arizona</i>									
Gila:									
Wellton-Mohawk division.....	40, 285	24, 637	5, 707, 153	231. 65					
Yuma Mesa division:									
North Gila unit.....	6, 424	6, 274	1, 589, 021	253. 27					
South Gila unit.....									
Yuma Mesa unit.....	19, 970	14, 211	1, 487, 436	104. 67					
Total, Gila project.....	66, 679	45, 122	8, 783, 610	194. 66					
Salt River.....	241, 322	192, 228	56, 639, 818	234. 66					
Yuma auxiliary.....	3, 305	2, 256	746, 404	330. 85					
Yuma:									
Reservation division:									
Bard unit (California).....	6, 867	6, 246	1, 200, 226	192. 16					
Indian unit (California).....	7, 743	4, 588	935, 965	204. 00					
Valley division (Arizona).....	51, 936	45, 497	16, 043, 765	352. 63					
Total, Yuma project.....	66, 546	56, 331	18, 179, 956	322. 73					
California									
Boulder Canyon:									
All-American canal system.....									
Coachella division.....	74, 800	49, 192	24, 578, 044	499. 63					
Imperial division ¹									
Total, Boulder Canyon project.....	74, 800	49, 192	24, 578, 044	499. 63					
Total, region 3.....	452, 652	345, 129	108, 927, 832	315. 61					
REGION 4									
Colorado									
Fruitgrowers Dam ⁴									
Grand Valley:									
Garfield gravity division.....	22, 811	21, 197	1, 924, 705	90. 80					
Garfield pumping division.....		361	34, 115	94. 50					
Orchard Mesa division ⁴	10, 027	8, 202	1, 684, 120	205. 33					
Special and Warren Act contractors.....									
Total, Grand Valley project.....	33, 199	29, 760	3, 642, 940	122. 41					
Mancos ⁵									
Paonia ⁴	11, 500	8, 900	935, 839	105. 15					
Pine River.....									
Pine River Indian irrigation.....									
Uncompagre.....	72, 743	57, 002	5, 077, 812	89. 08					

See footnotes at end of table.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954—Continued*

State, Project, and Subdivision	FULL SUPPLY PROJECTS ¹				SUPPLEMENTAL SUPPLY PROJECTS ²			
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value	
			Total	Per Irrigated Acre			Total	Per Irrigated Acre
REGION 4—continued								
Idaho								
Preston Bench ⁴	Acres	Acres			Acres	Acres	\$319,427	\$85.09
Nevada								
Humboldt					37,446	29,960	2,109,877	70.42
Newlands:								
North Carson division	7,558	4,845	\$262,138	\$54.10				
South Carson division	55,658	43,632	2,074,493	47.55				
Truckee division	7,125	5,499	262,774	47.79				
Total, Newlands project	70,341	53,976	2,599,405	48.16				
Nevada-California								
Truckee storage					29,200	22,786	1,726,580	75.77
Utah								
Hyrum					6,800	5,804	341,388	58.82
Moon Lake					75,256	54,054	1,162,602	21.51
Newton ⁵					2,200	1,969	111,235	56.49
Ogden River					22,905	16,165	1,733,500	107.24
Provo River: Deer Creek division					46,609	38,792	4,112,728	106.02
Sanpete:								
Ephraim division					7,630	6,733	293,284	43.56
Spring City division					6,023	5,320	208,000	39.10
Total, Sanpete project					13,653	12,053	501,284	41.59
Scofield ⁵					15,609	15,009	921,925	61.42
Strawberry Valley:								
Highline division	17,637	15,661	844,496	51.94				
Spanish Fork division	13,865	13,342	943,123	70.69				
Springville-Mapleton division	8,822	8,104	588,168	70.11				
Total, Strawberry Valley project	40,324	37,107	2,355,787	63.49				
Weber River					109,037	90,972	9,707,789	106.71

Total, region 4	228, 107	186, 745	14, 011, 783	78. 24	423, 081	342, 344	24, 477, 108	71. 50
REGION 5								
<i>New Mexico</i>								
Carlsbad	25, 055	17, 534	3, 332, 807	190. 08				
Fort Sumner	6, 500	5, 017	477, 863	95. 25				
Tucumcari	42, 214	29, 340	1, 764, 539	60. 14				
<i>New Mexico-Texas</i>								
Rio Grande: ¹⁰	102, 301	85, 834	25, 457, 529	296. 59				
Elephant Butte irrigation district (New Mexico)								
El Paso County water improvement district No. 1 (Texas)	76, 014	56, 594	15, 905, 562	281. 05				
Hudspeth County conservation and reclamation district No. 1 (Texas)								
Total-Rio Grande project	178, 315	142, 428	41, 363, 091	290. 41				
<i>Oklahoma</i>								
W. C. Austin	47, 809	44, 552	5, 207, 243	116. 88				
<i>Texas</i>								
Balmorhea ⁵					10, 608	7, 165	1, 421, 852	198. 86
Total, region 5	296, 893	238, 871	52, 145, 543	218. 30	10, 608	7, 165	1, 424, 852	198. 86
REGION 6								
<i>Montana</i>								
Buffalo Rapids:	13, 903	12, 317	616, 807	50. 08				
First division ⁵	9, 422	8, 573	418, 139	48. 77				
Second division ⁵								
Total Buffalo Rapids project	23, 325	20, 890	1, 034, 946	49. 54				
Huntley	32, 508	24, 229	1, 313, 735	54. 22				
Intake ⁵	881	592	18, 890	31. 91				
Milk River:								
Chinook division	43, 484	25, 380	1, 249, 374	49. 23				
Dodson pumping unit ⁵	1, 147	998	45, 960	46. 05				
Glasgow division	19, 407	12, 084	416, 525	34. 47				
Malta division	53, 733	24, 438	869, 203	33. 57				
Pump lands	6, 011	3, 331	274, 920	31. 57				
Total, Milk River project	123, 782	68, 231	2, 855, 982	41. 86				
Missouri River Basin: Yellowstone division: Savage unit	2, 215	2, 052	70, 178	34. 20				
<i>Sun River</i>								
Fort Shaw division	11, 084	7, 652	208, 612	27. 26				
Greenfield's division	84, 791	58, 874	2, 172, 769	36. 91				
Total, Sun River project	95, 875	66, 526	2, 381, 381	35. 80				

See footnotes at end of table.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954—Continued*

State, Project, and Subdivision	FULL SUPPLY PROJECTS ¹				SUPPLEMENTAL SUPPLY PROJECTS ²			
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value	
			Total	Per Irrigated Acre			Total	Per Irrigated Acre
REGION 6—continued <i>Montana-North Dakota</i>								
	<i>Acres</i>	<i>Acres</i>			<i>Acres</i>	<i>Acres</i>		
	37,272	32,081	\$1,768,515	\$55.13				
	19,928	16,419	881,560	53.69				
	57,200	48,500	2,650,075	54.64				
	10,314	8,964	347,577	37.77				
Lower Yellowstone: District No. 1 (Montana) District No. 2 (North Dakota) Leased and water rental lands Total, Lower Yellowstone project.								
<i>North Dakota</i> Buford-Trenton ⁴ Missouri River Basin: Heart division: Dickinson unit Heart Butte unit North Dakota pumping division: Fort Clark unit								
<i>South Dakota</i> Belle Fourche..... Missouri River Basin: Cheyenne division: Angostura unit ⁵ Rapid Valley ⁶								
<i>Wyoming</i> Riverton: Midvale irrigation district..... Third division..... Total, Riverton project.....								

<i>Wyoming-Montana</i>									
Shoshone:									
Framme division.....	20,083	10,771	371,809	34.52					
Garland division.....	35,950	32,880	1,934,188	39.37					
Heart Mountain division.....	27,978	22,593	1,297,021	37.41					
Willwood division.....	11,595	9,914	620,141	62.55					
Total, Shoshone project.....	95,606	75,858	4,223,159	55.67					
Totals—Region 6.....	565,765	427,395	20,309,213	47.52					
REGION 7									
<i>Colorado</i>									
Colorado-Big Thompson.....					615,000	615,000	6,615	201,988	30.53
<i>Nebraska</i>									
Mirage Flats ⁵	11,657	11,311	1,207,290	106.74					
Missouri River Basin:									
Bostrick division: Superior-Courtland unit.....	11,464	7,516	649,158	86.37					
Frenchman-Cambridge division ⁴	16,200	8,729	765,338	87.68					
<i>Nebraska-Wyoming</i>									
North Platte:									
Gering-Fort Laramie irrigation district.....	54,845	52,610	5,491,991	104.30					
Goshute irrigation district (Wyoming).....	52,484	50,217	4,265,593	84.94					
Northport irrigation district.....	16,170	13,073	738,923	38.03					
Pathfinder irrigation district.....	11 102,824	88,679	6,062,462	63.36					
Special and Warren Act contractors (Nebraska).....									
Special and Warren Act contractors (Wyoming).....									
Leased and water rental lands.....									
Total, North Platte project.....	226,323	204,579	16,578,969	81.04					
<i>Wyoming</i>									
Kendrick.....	22,128	13,168	541,689	41.14					
Total, region 7.....	287,772	245,303	19,742,444	80.48					
Total, all regions.....	3,105,523	2,509,078	356,432,108	142.06					

See footnotes at end of table.

Total, Minidoka project.....	747,780	711,688	55,113,078	77.44	1,183	1,183	109,695	92.73	1,086,505	1,013,708	81,195,871	80.10
<i>Montana</i>												
Bitter Root ⁴									16,865	16,456	543,106	33.00
Frenchtown.....									4,810	3,650	167,823	45.98
Missoula Valley ⁴									977	708	18,080	23.54
<i>Oregon</i>												
Arnold ⁴									4,248	3,091	307,298	99.42
Baker.....									7,312	7,305	253,300	34.67
Burnt River.....									15,230	15,115	620,210	41.03
Deschutes:												
Central Oregon irrigation district ⁴	2,520	2,460	0	0					46,739	42,328	4,256,205	100.55
Lone Pine irrigation district.....									2,620	2,460	0	0
North unit.....						6 1,614	1,614	156,977	97.26	51,614	49,501	144.59
Total, Deschutes project.....	2,520	2,460	0	0	6 1,614	1,614	156,977	97.26	6 100,873	94,289	11,413,565	121.05
Grants Pass ⁴									10,369	7,226	826,686	114.40
Oehoco ⁴									8,500	8,253	765,190	92.94
Umatilla:												
East division.....									10,911	7,017	345,477	49.23
South division:												
Standfield irrigation district ⁴									6,000	5,129	611,642	119.25
Westland irrigation district.....									8,196	3,665	299,973	52.95
West division.....					530	499	95,878	192.14	7,869	6,075	467,853	77.01
Total, Umatilla project.....					530	499	95,878	192.14	32,676	23,886	1,724,925	72.21
Vale.....									32,000	31,703	2,125,555	67.05
<i>Oregon-Idaho</i>												
Owyhee:												
Advancement irrigation district.....									700	579	93,429	161.36
Bench irrigation district.....									2,342	2,164	564,958	261.07
Crystal irrigation district.....									1,280	1,193	280,451	218.32
Gem irrigation district (Idaho).....									33,454	32,920	3,352,923	101.85
Ontario-Nyssa irrigation district.....									5,831	5,656	1,132,456	200.22
Owyhee irrigation district.....									49,553	47,566	4,451,563	93.59
Payette-Oregon Slope irrigation district.....									4,676	4,043	926,397	229.14
Ridgeview irrigation district.....									6,159	6,059	628,852	103.79
Slide irrigation district.....									1,144	1,097	162,021	147.69
Special and Warren Act contractors.....	13,800	12,860	3,257,568	253.31					13,800	12,860	3,257,568	253.31
Total, Owyhee project.....	13,800	12,860	3,257,568	253.31					118,939	114,137	14,830,618	129.94

See footnotes at end of table.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954—Continued*

State, Project, and Subdivision	SPECIAL AND WARREN ACT CONTRACTORS				LEASED AND WATER RENTAL LANDS				TOTAL AREA				
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		
			Total	Per Irrigated Acre			Total	Per Irrigated Acre			Total	Per Irrigated Acre	
State, Project, and Subdivision	REGION 1—CONTINUED												
	Washington												
	Columbia Basin:	Acres	Acres							Acres	Acres	\$8,024,216	\$185.04
	East Columbia Basin Irrigation district.												
	Quincy-Columbia Basin Irrigation district.											6,873,164	143.63
	South Columbia Basin Irrigation district.											1,355,348	103.39
	Total, Columbia Basin project.											16,252,728	155.79
	Okanogan.											708,507	192.53
	Yakima:												
	Kennebec division.											523,666	219.47
	Kititas division.											2,601,658	47.98
	Roza division.											13,329,084	205.06
	Sunnyside division.											15,385,912	192.00
	Tieton division.											21,314,912	874.89
	Special and Warren Act contractors.	181,761	163,967	\$36,382,111	\$221.89							36,382,111	221.89
	Total, Yakima project.	181,761	163,967	36,382,111	221.89	270	209	40,082	191.78	449,099	390,073	89,537,343	229.54
Total, region 1.	1,078,702	1,014,529	107,235,838	105.70	3,597	3,505	402,632	114.87	2,445,897	2,166,924	252,713,495	116.62	
REGION 2													
California													
Central Valley ¹	806,775	634,258	166,351,321	262.28					806,775	634,258	166,351,321	262.28	
Orland									19,422	17,243	1,510,688	87.61	
Oregon-California													
Klamath:													
Main division (Oregon).									8,39,361	34,007	4,215,831	123.97	
Tule Lake division (California).									9,44,430	43,354	5,323,963	122.80	
Special and Warren Act contractors.	93,569	86,133	8,116,739	94.23					93,569	86,133	8,116,739	94.23	
Leased and water rental lands.					71,923	31,805	1,810,451	56.92	71,923	31,805	1,810,451	56.92	

Total, Klamath project.....	93,569	86,133	8,116,739	94.23	71,923	31,805	1,810,451	56.92	249,283	195,299	19,466,984	99.68
Total, region 2.....	900,344	720,391	174,468,060	242.19	71,923	31,805	1,810,451	56.92	1,075,480	846,800	187,328,993	221.22
REGION 3												
Arizona												
Gila:												
Wellton-Mohawk division.....												
Yuma Mesa division:												
North Gila unit.....	924	622	68,346	109.88								
South Gila unit.....	846	845	123,000	145.56								
Yuma Mesa unit.....												
Total, Gila project.....	1,770	1,467	191,346	130.43								
Salt River.....	95,755	86,882	21,725,400	250.06								
Yuma auxiliary.....	117	114	28,673	251.52								
Arizona-California												
Yuma:												
Reservation division:												
Bard unit (California).....												
Indian unit (California).....												
Valley division (Arizona).....												
Total, Yuma project.....												
California												
Boulder Canyon:												
All-American canal system.....												
Coachella division.....												
Imperial division.....	530,000	452,391	90,781,905	200.67								
Total, Boulder Canyon project.....	530,000	452,391	90,781,905	200.67								
Total, region 3.....	627,642	540,854	112,727,324	208.42								
REGION 4												
Colorado												
Fruitgrowers Dam.....												
Grand Valley:												
Garfield gravity division.....					1,421	73	6,387	87.49	24,232	21,270	1,931,092	90.79
Garfield pumping division.....									361	361	34,115	94.50
Orchard Mesa division.....									8,202	8,202	1,684,120	205.33
Special and Warren Act contractors.....	9,045	7,730	1,528,805	197.78					9,045	7,730	1,528,805	197.78
Total, Grand Valley project.....	9,045	7,730	1,528,805	197.78	1,421	73	6,387	87.49	43,665	37,563	5,178,132	137.85

See footnotes at end of table.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954—Continued*

State, Project, and Subdivision	SPECIAL AND WARREN ACT CONTRACTORS				LEASED AND WATER RENTAL LANDS				TOTAL AREA			
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value	
			Total	Per Irrigated Acre			Total	Per Irrigated Acre			Total	Per Irrigated Acre
REGION 4—continued												
Colorado—continued												
Mancos ⁵		Acres			Acres				Acres		\$211,746	\$28.70
Panola ⁴									11,500	8,900	935,839	105.15
Pine River									38,728	32,810	970,722	29.59
Pine River Indian irrigation									9,875	8,989	241,083	26.92
Uncomphare	15,913	15,524	\$665,236	\$42.85					88,556	72,526	5,743,048	79.19
Idaho												
Preston Bench ⁴									4,500	3,754	319,427	85.09
Nevada												
Humboldt									37,446	29,960	2,109,877	70.42
Newlands:												
North Carson division									7,558	4,845	262,138	54.10
South Carson division									55,638	43,632	2,074,493	47.55
Truckee division									7,125	5,499	262,774	47.79
Total Newlands project									70,341	53,976	2,599,405	48.16 K
Nevada-California												
Truckee storage									29,200	22,786	1,726,580	75.77
Utah												
Hyrum									6,800	5,804	341,388	58.82
Moon Lake									75,256	54,054	1,162,002	21.51
Newton ⁵									2,200	1,969	111,235	56.49
Ogden River									22,905	16,165	1,733,500	107.24
Provo River: Deer Creek division									46,909	38,792	4,112,728	106.02
Sanpete:												
Ephraim division									7,630	6,733	293,284	43.56
Spring City division									6,023	5,320	208,000	39.10
Total Sanpete project									13,653	12,053	501,284	41.59
Grandfield ⁶									15,909	15,009	921,925	61.42

[illegible]

See footnotes at end of table.

TABLE 5.—*Projects in operation—irrigation and crop value data for the calendar year 1954—Continued*

State, Project, and Subdivision	SPECIAL AND WARREN ACT CONTRACTORS			LEASED AND WATER RENTAL LANDS			TOTAL AREA			
	Irrigable Area for Service ³	Irrigated Area	Gross Crop Value		Irrigable Area for Service ³	Irrigated Area	Gross Crop Value			
			Total	Per Irrigated Acre			Total	Per Irrigated Acre		
REGION 6—continued Montana—continued										
	Milk River:	Acres	Acres			Acres	Acres	\$1,249,374	\$49.23	
	Chinook division.....					43,484	25,380	45,960	46.05	
	Dodson pumping unit ⁴					1,147	998	416,525	34.47	
	Glasgow division.....					19,407	12,084	869,203	35.57	
	Malta division.....					53,733	24,438	274,920	51.57	
	Pump lands.....					6,011	5,331			
	Total, Milk River project.....					123,782	68,231	2,855,982	41.86	
	Missouri River Basin: Yellowstone division:									
	Savage unit.....					2,215	2,052	70,178	34.20	
	Sun River:									
	Fort Shaw division.....			38		11,122	7,690	209,927	27.30	
	Greenfields division.....					84,791	58,874	2,172,769	36.91	
	Total, Sun River project.....			38		95,913	66,564	2,382,696	35.80	
	Montana-North Dakota									
	Lower Yellowstone:									
	District No. 1 (Montana).....						37,272	32,081	1,768,515	55.13
	District No. 2 (North Dakota)						19,928	16,419	881,560	53.69
	Leased and water rental lands.....					516	516	516	20,427	39.59
Total, Lower Yellowstone project.....					516	516	49,016	2,670,502	54.48	
North Dakota										
Buford-Trenton ⁴										
Missouri River Basin:										
Heart division:						10,314	8,964	347,577	37.77	
Dickinson unit.....										
Heart Butte unit.....					279	15,293	279	15,293	54.81	
North Dakota pumping division: Fort Clark unit.....					105	7,582	105	7,582	72.21	
					70	1,049	70	1,049	37.59	

SUMMARY

	Irrigable area for service ³	Irrigated area	Gross crop value	
			Total	Per irrigated acre
Full supply projects.....	<i>Acres</i> 3, 105, 523	<i>Acres</i> 2, 509, 078	\$356, 432, 108	\$142. 06
Supplemental supply projects.....	1, 253, 066	1, 148, 983	95, 766, 484	83. 35
Special and Warren Act contractors.....	2, 763, 129	2, 421, 577	409, 990, 824	169. 31
Leased and water rental lands.....	110, 052	46, 128	2, 827, 266	61. 29
Grand total.....	7, 231, 770	6, 125, 766	865, 025, 682	141. 21
Grand total, 1953.....	7, 147, 528	6, 097, 615	785, 939, 868	126. 92
Increase, 1953-54 total.....	+84, 242	+28, 151	+79, 085, 814	+14. 29

¹ Projects receiving or to receive entire water supply from facilities constructed, rehabilitated or improved by the Bureau.

² Projects receiving or to receive only a partial water supply from Bureau facilities. Area for which the Bureau is prepared to supply water for irrigation. These lands contain a minor acreage of class 6 nonproductive land which is irrigated with excess water for a temporary period on an annual water rental basis.

⁴ Private project reconstructed or rehabilitated with Government funds.

⁵ Water conservation and utilization project.

⁶ 1,614 acres of nonirrigable land irrigated with water from wasteways and water allotted to irrigable lands.

⁷ Special contract.

⁸ Of this irrigable area for service, 929 acres are in California and 38,432 acres are in Oregon.

⁹ Of this irrigable area for service, 42,340 acres are in California and 2,090 acres are in Oregon.

¹⁰ Irrigable area increased to include acreage not shown in earlier reports as follows: Elephant Butte Irrigation district 11,661 acres of suspended land and 2,640 acres of class 1-4 land; El Paso County water improvement district No. 1, 7,004 acres of suspended land and 1,880 acres of class 1-4 land.

¹¹ Of this irrigable area for service 100,949 acres are in Nebraska and 1,875 acres are in Wyoming.

NOTE.—Per acre value based on irrigated area.

TABLE 6.—Cumulative crop values, 1906-54

Year	Federal irrigation projects ¹				Warren Act lands and special contractors				Entire area			
	Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value	
			For year	Cumulative total			For year	Cumulative total			For year	Cumulative total
1906.....	39,300	2 22,300	2 \$244,900	2 20,100	---	---	---	---	2 22,300	2 20,100	2 \$244,900	\$5,005,360
1907.....	206,300	2 187,628	2 4,760,460	2 169,000	---	---	---	---	2 187,628	2 169,000	2 4,760,460	24,641,248
1908.....	488,942	2 289,549	2 7,635,888	2 200,500	---	---	---	---	2 289,549	2 200,500	2 7,635,888	24,561,911
1909.....	730,601	410,628	11,920,663	410,628	---	---	---	---	410,628	410,628	11,920,663	37,536,774
1910.....	917,751	473,423	37,536,550	473,423	---	---	---	---	473,423	473,423	37,536,550	65,137,142
1911.....	1,042,609	564,681	13,121,224	564,681	---	---	---	---	564,681	564,681	13,121,224	80,869,357
1912.....	1,255,286	618,680	14,479,368	618,680	---	---	---	---	618,680	618,680	14,479,368	97,344,874
1913.....	1,255,381	699,183	16,475,517	699,183	---	---	---	---	699,183	699,183	16,475,517	115,509,326
1914.....	1,240,875	701,271	17,342,874	701,271	---	---	---	---	701,271	701,271	17,342,874	148,325,298
1915.....	1,472,772	856,778	18,164,452	856,778	---	---	---	---	856,778	856,778	18,164,452	204,787,611
1916.....	1,405,452	922,821	18,825,298	922,821	---	---	---	---	922,821	922,821	18,825,298	243,587,894
1917.....	1,599,525	1,057,513	19,221,967	1,057,513	---	---	---	---	1,057,513	1,057,513	19,221,967	273,905,314
1918.....	1,732,374	1,141,516	20,363,483	1,141,516	---	---	---	---	1,141,516	1,141,516	20,363,483	307,937,887
1919.....	1,636,159	1,187,255	21,550,738	1,187,255	---	---	---	---	1,187,255	1,187,255	21,550,738	338,937,434
1920.....	1,681,960	1,223,480	22,774,218	1,223,480	---	---	---	---	1,223,480	1,223,480	22,774,218	370,381,464
1921.....	1,674,100	1,227,500	24,001,718	1,227,500	---	---	---	---	1,227,500	1,227,500	24,001,718	401,865,364
1922.....	1,692,700	1,262,180	25,263,900	1,262,180	---	---	---	---	1,262,180	1,262,180	25,263,900	433,333,024
1923.....	1,718,400	1,293,700	26,557,600	1,293,700	---	---	---	---	1,293,700	1,293,700	26,557,600	465,801,824
1924.....	1,805,730	1,326,800	27,884,400	1,326,800	---	---	---	---	1,326,800	1,326,800	27,884,400	498,269,374
1925.....	1,844,550	1,361,300	29,245,700	1,361,300	---	---	---	---	1,361,300	1,361,300	29,245,700	530,736,824
1926.....	1,884,550	1,401,300	30,647,000	1,401,300	---	---	---	---	1,401,300	1,401,300	30,647,000	562,203,374
1927.....	1,936,900	1,442,080	32,089,000	1,442,080	---	---	---	---	1,442,080	1,442,080	32,089,000	593,680,824
1928.....	1,882,930	1,488,240	33,577,240	1,488,240	---	---	---	---	1,488,240	1,488,240	33,577,240	625,148,374
1929.....	1,922,330	1,533,900	35,111,140	1,533,900	---	---	---	---	1,533,900	1,533,900	35,111,140	656,615,824
1930.....	1,943,390	1,580,810	36,691,950	1,580,810	---	---	---	---	1,580,810	1,580,810	36,691,950	688,083,374
1931.....	2,037,260	1,627,718	38,319,668	1,627,718	---	---	---	---	1,627,718	1,627,718	38,319,668	719,550,824
1932.....	2,036,074	1,675,144	40,000,000	1,675,144	---	---	---	---	1,675,144	1,675,144	40,000,000	750,301,374
1933.....	2,025,508	1,722,124	41,722,124	1,722,124	---	---	---	---	1,722,124	1,722,124	41,722,124	781,052,824
1934.....	2,025,508	1,770,124	43,492,248	1,770,124	---	---	---	---	1,770,124	1,770,124	43,492,248	812,363,374
1935.....	2,113,500	1,818,124	45,310,372	1,818,124	---	---	---	---	1,818,124	1,818,124	45,310,372	843,674,824
1936.....	2,106,409	1,869,124	47,179,496	1,869,124	---	---	---	---	1,869,124	1,869,124	47,179,496	874,986,374
1937.....	2,194,830	1,918,124	49,097,620	1,918,124	---	---	---	---	1,918,124	1,918,124	49,097,620	906,297,824
1938.....	2,275,882	1,967,124	51,064,744	1,967,124	---	---	---	---	1,967,124	1,967,124	51,064,744	937,609,374
1939.....	2,462,740	2,016,124	53,080,868	2,016,124	---	---	---	---	2,016,124	2,016,124	53,080,868	968,920,824
1940.....	2,780,811	2,065,124	55,145,992	2,065,124	---	---	---	---	2,065,124	2,065,124	55,145,992	1,000,231,374
1941.....	3,487,816	2,115,124	57,261,116	2,115,124	---	---	---	---	2,115,124	2,115,124	57,261,116	1,031,542,824
1942.....	3,547,944	2,164,124	59,425,240	2,164,124	---	---	---	---	2,164,124	2,164,124	59,425,240	1,062,854,374
1943.....	2,957,806	2,213,124	61,638,364	2,213,124	---	---	---	---	2,213,124	2,213,124	61,638,364	1,094,165,824
1944.....	2,970,714	2,262,124	63,900,488	2,262,124	---	---	---	---	2,262,124	2,262,124	63,900,488	1,125,477,374

1945.....	2,975,590	2,416,961	2,464,672	232,545	321	2,701,518	332,2,054,746	1,745,627	1,731,060	202,639	074	1,745,054	366,5,030,336	4,162,588	4,195,732	435,184	395	4,446,572	608
1946.....	3,079,761	2,513,687	2,567,050	279,711	300	2,981,229	632,2,071,070	1,808,282	1,829,531	250,912	645	1,995,967	011,5,150,331	4,321,969	4,396,581	530,623	945	4,977,196	643
1947.....	3,091,077	2,629,727	2,683,253	300,474	560	3,281,704	192,2,074,806	1,831,975	1,871,099	254,946	244	2,250,913	255,5,166,783	4,481,702	4,554,352	555,420	804	5,532,617	447
1948.....	3,221,654	2,964,619	2,760,498	277,160	874	3,558,865	086,2,158,551	1,894,136	1,939,241	257,462	667	2,508,375	922,5,380,015	4,558,735	4,699,734	534,623	541	6,067,240	988
1949.....	3,266,297	2,792,108	2,848,896	277,347	763	3,836,912	899,2,382,215	2,098,481	2,067,338	238,981	245	2,747,357	167,5,678,512	4,890,589	4,916,234	516,329	008	6,583,569	996
1950.....	3,398,168	2,857,583	2,918,105	287,683	368	4,123,896	137,2,626,342	2,219,653	2,271,358	290,554	341	3,037,911	508,6,024,510	5,077,198	5,189,463	578,237	709	7,181,807	705
1951.....	4,049,409	3,396,094	3,624,269	445,407	191	4,569,303	888,2,663,006	2,279,673	2,317,714	376,314	474	3,414,223	892,6,713,018	5,875,769	5,942,013	851,721	665	7,983,599	370
1952.....	4,264,906	3,613,544	3,681,216	504,614	596	5,073,817	984,2,729,572	2,312,206	2,345,138	451,135	159	3,845,361	141,6,994,478	6,385,760	6,026,354	935,679	735	8,919,209	125
1953.....	4,354,911	3,728,218	3,784,963	417,790	763	5,491,638	747,2,792,617	2,369,397	2,407,453	308,149	105	4,213,510	246,7,147,528	6,097,613	6,192,416	785,939	868	9,703,148	993
1954.....	4,468,641	3,704,189	3,757,365	455,025	858	5,946,664	605,2,763,129	2,421,577	2,437,766	409,999	824	4,623,510	070,7,231,770	6,125,766	6,196,131	865,023	082	10,570,174	675

¹ Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by the United States.

² Estimated.

Land Openings

During fiscal year 1955, the Bureau conducted 4 land openings on 2 reclamation projects, making 243 farm units embracing 23,514 irrigable acres of new land available for settlement.

As in previous years, the majority of these units was on the Columbia Basin project in Washington where 149 units were offered for sale under provisions of the Columbia Basin Project Act. The remaining 94 units were opened for settlement under provisions of reclamation and homestead laws in the Northside pumping unit of the Minidoka project in Idaho. Public response to the announced availability of new farm units under the Bureau's settlement program continued at the high level evidenced since the close of World War II, with an average of nearly 100 qualified applicants for each unit offered.

Since the close of World War II, 48 land openings have been held on 13 reclamation projects. A total of 2,166 new farm units encompassing nearly 183,000 irrigable acres of public land has thus been made available for selection by qualified applicants.

Both technical and financial assistance has continued to be available to settlers during developmental years through cooperative working relationships established by the Bureau with the Farmers Home Administration, the Agricultural Extension Service, the several State colleges and universities, and other similarly appropriate agencies.

During fiscal year 1956 the availability of additional new farm units is anticipated on the Columbia Basin and Yakima projects in Washington, the Minidoka project in Idaho, and the Gila project in Arizona.

Development Farms

The development farm program on new irrigation projects was begun in 1947 and has been continued in cooperation with Department of Agriculture agencies and State agricultural colleges.

The purpose of the farms is to demonstrate effective methods of irrigation and good cropping practices; to determine crops best adapted to the area, and water requirements of the crops; and to demonstrate other approved practices with which the new settlers may have had little or no experience. The farms also aid in determining the feasibility of developing certain areas for irrigation where the quality of the soil and water may be questionable.

From 10 to 20 percent of most farms are set aside for research by the cooperating agencies on special problems which may be encountered in the area. Field days, tours, and other educational media are employed to disseminate the information obtained from the research and to explain the demonstrations to the farmers on the proj-

ect. Over 22,000 local settlers and others interested in the work have visited the farms.

New settlers have been aided materially through the development farm program in making an early success of their irrigated farms, which in turn has helped safeguard the Government's investment in the construction of irrigation projects.

To date 23 development farms have been established of which 7 have served their purpose and have been discontinued. It is expected that 2 or 3 of the presently operated farms will be discontinued at the end of the 1955 operating season. Plans have been made to establish about 4 new farms next fiscal year. The present farms are located in the Columbia Basin, Missouri River Basin, and Gila projects.

Repayment and Water Service Contracts

During fiscal year 1955 contracts were executed with nine irrigation districts for the repayment of the cost of new irrigation works. Twenty-six water users' organizations signed contracts for the purchase of storage water rights or for interim and long-term water service. Pursuant to special authorizing legislation, basic amendatory construction repayment contracts were executed with 8 irrigation districts. Negotiations of basic amendatory construction repayment contracts are under way or scheduled with 5 irrigation districts. These contracts will require special congressional authorization. Amendatory contracts were executed with an additional 20 organizations to provide for such matters as the transfer of operation and maintenance of the irrigation works to the water users and the repayment of the cost of rehabilitation and betterment programs.

Soil and Moisture Conservation Operations

The Bureau of Reclamation has continued its soil and moisture conservation program in keeping with the Department's policy of conserving the natural resources on lands under its jurisdiction.

The program objectives are accomplished in cooperation with other Federal agencies as well as State and local agencies. Water users' organizations assist in planning the work and in many cases furnish a part of the labor, materials, and funds.

The activities have included erosion control and water conservation on acquired and withdrawn lands, protection of reservoirs and other irrigation facilities, and general betterment of the lands in the Bureau's custody. Some of the particular work undertaken during this year included reseeding watershed areas, sand dune control, salt cedar control investigations, soil stabilization and stream control.

Drainage

Drainage for the disposal of surplus ground water is, of necessity, an integral part of an irrigation system. It has been found, however, that it is not fully possible to predict the nature of a drainage problem prior to its actual occurrence on a project.

Hence, drainage problems fall into three stages of project development: First, the initial stages of project operation during which ground-water accumulations must be studied by analysis of systematically collected data on project ground-water elevations; second, a stage in which ground-water elevations adversely affect crop production and drains or wells must be constructed to remove surplus water; and third, a period of maintenance and minor extension of drainage to new problem areas.

There are Bureau of Reclamation projects in all of these stages but it is possible to report that during fiscal year 1955 there was no case of drainage problems being of great magnitude. Ground-water elevations were being studied on new projects, particularly those in the Missouri River Basin project where problems are expected. There were no major drains under construction during the year. Regular maintenance of drains continued, with trouble from erosion being experienced in a few places.

The Bureau recognizes that prevention of ground-water accumulation would eliminate drainage problems. Hence, many canals and laterals have been lined to prevent seepage. In some areas, particularly on the North Platte project in Nebraska, lining has been so effective that it has been possible to abandon drains or to refill the drains and place the land in cultivation.

The Bureau also has a continuing program of education of water users in the proper use of water to the end that waste and overirrigation will be reduced with a consequent reduction in drainage problems.

Weed Control

During the past year, continued progress was made in developing and applying more economical methods of weed control.

Of particular importance in this field is the research being conducted in cooperation with the Weed Investigations Section, Agricultural Research Service, Department of Agriculture. This research is undertaken at four field stations established in the West by that Department with locations at Phoenix, Ariz.; Prosser, Wash.; Logan, Utah; and Bozeman, Mont.

In the Bureau's Denver laboratories special attention has been given to developing better methods for controlling salt cedar, submersed

waterweeds, and algae. The use of radioactive isotopes in tracing the movement and concentration of herbicides in plant tissues also has been continued in Denver.

Both Federal and private irrigation districts have been kept advised of the new developments in weed control through motion pictures, slide lectures, Reclamation Era articles, handbooks, and other educational media prepared by the Bureau or prepared in cooperation with other agencies.

Cooperation With Other Agencies

The Bureau of Reclamation has worked closely during the fiscal year with units in the Department of Agriculture, the State colleges and extension services, and other Federal, State, and local agencies.

Many phases of the Bureau's activities in planning, developing, and operating irrigation projects in the 17 Western States lend themselves to such cooperation. The cooperative undertakings with these agencies have been carried out through memorandums of understanding or cooperative agreements.

Of the 158 agreements now in effect, 33 were executed during the past fiscal year.

Public Use of Reservoirs

Construction of dams and reservoirs for irrigation and power development provides incidental but very definite benefits through the creation of exceptional public use opportunities. This is particularly true in the more arid parts of the West.

However, except as provided by law in specific instances, the Bureau of Reclamation is not authorized to expend funds for development of reservoir areas for public uses.

At certain reservoirs where possibilities for use by the public are deemed to be of national significance, such as Lake Mead, on the Colorado River between Arizona and Nevada; Franklin D. Roosevelt Lake, on the Columbia River in Washington; Millerton Lake on the San Joaquin River in California; and Shadow Mountain Lake and Lake Granby on the Colorado River in Colorado, responsibility for the development and administration of public use facilities has been delegated to the National Park Service.

The National Park Service is, in effect, the agent of the Bureau in all public use matters and negotiates for the development and administration, by local or State governmental agencies, of reservoir areas which are of local or State significance. Facilities at reservoirs wholly or substantially within national forest boundaries are administered by the United States Forest Service.

Federal Tax Revenues and Reclamation

Each step taken in the development of the Nation's basic resources moves the economy of the Nation to a new and higher plateau. This is strikingly demonstrated in an analysis of Federal tax revenues from Federal reclamation project areas.

Based on the projected results of a sample study of 15 reclamation projects, the estimated cumulative return to the Treasury from the 73 projects or divisions of projects receiving water under the Federal reclamation program in 1954 now stands at approximately \$4 billion. This is an amount greater than total reclamation expenditures for all project works since the beginning of the Federal reclamation program in 1902.

The benefits accruing to the Nation through reclamation development are also measured in terms of families served, crop production and value, livestock raised, and acres irrigated. They are expressed in rapidly expanding trade and business activity, in direct repayment to the Government by the beneficiaries of reclamation, in increased population on and adjacent to projects, and in a wide variety of other phenomena.

These are all tangible, measurable benefits of a broad and lasting nature. They translate into expanding business activities in the project and surrounding areas. They filter to every State in the Union and every segment of society. They provide through this process additional economic stability to the Nation, which is reflected in part by increased revenues to the Treasury, and to the States and areas as well as on the projects themselves.

The estimate of Federal tax revenues from reclamation project areas is, therefore, only a partial measure of the true contribution of basic reclamation resource development to the Nation's tax structure and to the economy as a whole.

In 1954, individual income taxes paid directly by irrigation farmers and by persons of the neighboring towns and villages whose business or employment was affected by the construction of 15 selected reclamation projects were estimated at \$106 million. The aggregate individual income tax revenues from this sample study area since income tax collections started in 1916 is estimated at over \$900 million.

In addition to individual tax revenues, an appropriate share of corporation and excise tax revenues collected in the same 15 project areas is directly attributable to reclamation development. Estimated receipts from these sources total nearly \$500 million. The combined returns from individual and corporate tax revenues accordingly are estimated at \$1.4 billion.

Total Federal project construction cost through June 30, 1954, for the same projects aggregated \$273 million. Thus far, Federal tax revenues from these 15 project areas total more than 5 times the total cost of project facilities and about $7\frac{1}{2}$ times the direct cost of irrigation facilities.

DIVISION OF POWER

The installed capacity and the generation of hydroelectric power from Bureau of Reclamation multipurpose projects and from projects for which the Bureau is responsible for marketing the power, increased 324,600 kilowatts during fiscal year 1955. On June 30, 1955, the installed capacity of powerplants constructed and operated by the Bureau of Reclamation totaled 4,854,550 kilowatts whereas the capacity installed and operated by other agencies for which the Bureau is the marketing agent totaled 356,500 kilowatts.

Sale of electric power during the year aggregated 25,031,325,608 kilowatt-hours, with revenues from sales totaling \$51,764,256.48, as shown in table 7. This compares to the previous year's sales of 25,071,363,414 kilowatt-hours, and revenues of \$50,812,260.06.

Present Installed Capacity

During the fiscal year ending June 30, 1955, the Bureau of Reclamation operated 34 powerplants with a total nameplate capacity of 4,854,550 kilowatts, an increase of 133,100 kilowatts over the fiscal year 1954 figures. In addition, the Bureau marketed the power generated from plants constructed by the Corps of Engineers and the International Boundary Water Commission, totaling 356,500 kilowatts.

The capacity installed during fiscal year 1955 is as follows:

Bureau of Reclamation:	Kilowatts
Central Valley project-----	67, 500
Kendrick project -----	36, 000
Eklutna project -----	32, 000
Yakima project (Prosser powerplant retired)-----	—2, 400
	133, 100
U. S. Corps of Engineers: Missouri River Basin project Fort Randall---	160, 000
International Boundary Water Commission: Falcon Dam-----	31, 500
Total-----	324, 600

Additional Capacity Under Construction

At the end of fiscal year 1955, the Bureau of Reclamation had under construction 4 powerplants, which will have an ultimate in-

stalled nameplate capacity of 198,000 kilowatts. They are: Palisades, on the Snake River in Idaho; Chandler, Yakima River, Wash.; Fremont Canyon and Glendo, both on the North Platte River in Wyoming.

The United States Army Corps of Engineers is proceeding with the construction of its plants on the Missouri River Basin project. The ultimate nameplate capacity of the 3 plants—Garrison, in North Dakota; and Gavins Point and Oahe, in South Dakota—under construction by the corps will total 925,000 kilowatts. The Bureau of Reclamation will be the marketing agent for energy generated from these plants as in the case for other plants constructed by the Corps on the Missouri River Basin project.

TABLE 7.—Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1955¹

Projects	Sales of electric energy, kilowatt-hours	Revenues from sales
Boise project.....	152, 926, 558	\$295, 431. 32
Columbia Basin project ²	14, 224, 966, 000	12, 651, 264. 59
Minidoka project.....	139, 614, 733	583, 458. 07
Yakima project.....	23, 082, 435	58, 372. 53
Hungry Horse project ³	958, 839, 110	3, 620, 620. 73
Central Valley project.....	2, 058, 810, 064	8, 120, 810. 14
Boulder Canyon project.....	3, 533, 591, 876	8, 342, 320. 08
Parker-Davis project.....	1, 421, 474, 140	5, 646, 965. 76
Yuma project.....	6, 567, 642	20, 601. 22
Rio Grande project.....	90, 921, 175	633, 862. 40
Falcon Dam project.....	92, 261, 200	249, 105. 25
Fort Peck project.....	485, 136, 548	2, 005, 251. 08
North Platte project.....	66, 867, 824	452, 191. 59
Missouri River Basin—Western Division, including systems of River- ton, Shoshone, Colorado-Big Thompson, and Kendrick projects.....	944, 268, 024	5, 890, 997. 87
Missouri River Basin, eastern division.....	789, 590, 196	2, 773, 147. 94
Eklutna project, Alaska.....	42, 408, 083	419, 855. 91
Grand total.....	25, 031, 325, 608	51, 764, 256. 48

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Totals include 13,617,296,841 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$12,347,430 in payments by that agency not including river regulation benefits.

³ Totals include 956,270,860 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$3,609,000 in payments by that agency.

Authorized To Be Constructed

Authorized but not yet under construction by the Bureau of Reclamation as a part of multipurpose Reclamation facilities are 31 powerplants with an ultimate total nameplate capacity of 1,037,350 kilowatts.

The status of hydroelectric powerplants on reclamation projects is shown in table 8.

TABLE 8.—*U. S. Department of the Interior, Bureau of Reclamation, hydroelectric power plants*

A. CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Calendar year of initial operation	Nameplate capacity		Number and nameplate capacity of generators	
				Existing (kilowatts)	Ultimate (kilowatts)	Existing (kilowatts)	Ultimate (kilowatts)
1. Alaska.....	Eklutna.....	Eklutna.....	1955	30,000	30,000	2-15,000.....	2-15,000.
2. Alaska.....	do.....	Little Eklutna ¹	1955	2,000	2,000	2-1,000.....	2-1,000.
3. Arizona-Nevada.....	Boulder Canyon.....	Hoover ²	1936	1,354,800	1,354,300	{14-82,500; 1-40,000; 2-2,400.....	14-82,500; 1-40,000; 2-2,400.
4. Arizona-Nevada.....	Parker-Davis.....	Davis.....	1951	225,000	225,000	5-45,000.....	5-45,000.
5. Arizona-Nevada.....	do.....	Parker.....	1942	120,000	120,000	4-30,000.....	4-30,000.
6. California.....	Central Valley.....	Folsom.....	1955	54,000	162,000	1-54,000.....	3-54,000.
7. California.....	do.....	Keswick.....	1949	75,000	75,000	3-25,000.....	3-25,000.
8. California.....	do.....	Nimbus.....	1955	13,500	13,500	2-6,750.....	2-6,750.
9. California.....	do.....	Shasta.....	1944	379,000	379,000	5-75,000; 2-2,000.....	5-75,000; 2-2,000.
10. California.....	Yuma.....	Siphon Drop.....	1926	1,600	1,600	2-800.....	2-800.
11. Colorado.....	Colorado-Big Thompson.....	Estes.....	1950	45,000	45,000	3-15,000.....	3-15,000.
12. Colorado.....	do.....	Flatiron.....	1954	71,500	71,500	2-31,500; 1-8,500.....	2-31,500; 1-8,500.
13. Colorado.....	do.....	Green Mountain.....	1943	21,600	21,600	1-10,800.....	1-10,800.
14. Colorado.....	do.....	Marys Lake.....	1951	8,100	8,100	1-8,100.....	1-8,100.
15. Colorado.....	do.....	Polehill.....	1954	33,250	33,250	1-33,250.....	1-33,250.
16. Colorado.....	Grand Valley.....	Grand Valley ³	1932	3,000	3,000	2-1,500.....	2-1,500.
17. Idaho.....	Bolse.....	Anderson Ranch.....	1950	27,000	40,500	2-13,500.....	3-13,500.
18. Idaho.....	do.....	Black Canyon.....	1925	8,000	8,000	2-4,000.....	2-4,000.
19. Idaho.....	do.....	Boise Diversion.....	1912	1,500	1,500	3-500.....	3-500.
20. Idaho.....	Missouri River Basin.....	Mimdoka.....	1909	13,400	13,400	1-5,000; 1-2,400; 5-1,200.....	1-5,000; 1-2,400; 5-1,200.
21. Montana.....	Hungry Horse.....	Canyon Ferry.....	1953	50,000	50,000	3-16,667.....	3-16,667.
22. Montana.....	Rio Grande.....	Hungry Horse.....	1952	285,000	285,000	4-71,250.....	4-71,250.
23. New Mexico.....	do.....	Elephant Butte.....	1940	24,300	24,300	3-8,100.....	3-8,100.
24. South Dakota.....	Missouri River Basin.....	Angostura.....	1951	1,200	1,200	1-1,200.....	1-1,200.
25. Washington.....	Columbia Basin.....	Grand Coulee.....	1941	1,974,000	1,974,000	18-108,000; 3-10,000.....	18-108,000; 3-10,000.
26. Wyoming.....	Kendrick.....	Alcoa.....	1955	36,000	36,000	2-18,000.....	2-18,000.
27. Wyoming.....	do.....	Seminole.....	1939	32,400	32,400	3-10,800.....	3-10,800.
28. Wyoming.....	Missouri River Basin.....	Boysen.....	1952	15,000	15,000	2-7,500.....	2-7,500.
29. Wyoming.....	do.....	Kortes.....	1950	36,000	36,000	3-12,000.....	3-12,000.
30. Wyoming.....	North Platte.....	Guernsey.....	1927	4,800	4,800	2-2,400.....	2-2,400.
31. Wyoming.....	do.....	Lingle.....	1919	1,400	1,400	2-400; 2-300.....	2-400; 2-300.
32. Wyoming.....	Riverton.....	Pilot Butte.....	1925	1,600	1,600	2-800.....	2-800.
33. Wyoming.....	Shoshone.....	Heart Mountain.....	1948	5,000	5,000	1-5,000.....	1-5,000.
34. Wyoming.....	do.....	Shoshone.....	1922	5,600	5,600	1-4,000; 2-800.....	1-4,000; 2-800.
Subtotal A.....				4,854,550	5,080,550		

See footnotes at end of table.

TABLE 8.—*U. S. Department of the Interior, Bureau of Reclamation, hydroelectric power plants—Continued*
 B. CONSTRUCTED AND OPERATED BY OTHERS—POWER MARKETED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Calendar year of initial operation	Nameplate capacity		Number and nameplate capacity of generators	
				Existing (kilowatts)	Ultimate (kilowatts)	Existing (kilowatts)	Ultimate (kilowatts)
1. Montana	Fort Peck (USOE)	Fort Peck	1943	85,000	165,000	2-35,000; 1-15,000	2-35,000; 2-40,000; 1-15,000.
2. South Dakota	Missouri River Basin (USOE)	Fort Randall	1954	240,000	320,000	6-40,000	8-40,000.
3. Texas	Falcon Dam (IBWC)	Falcon	1954	31,500	31,500	3-10,500	3-10,500.
Subtotal B.				356,500	516,500		

C. UNDER CONSTRUCTION BY BUREAU OF RECLAMATION

1. Idaho	Palisades	Palisades	1956	0	114,000	0	4-28,500.
2. Washington	Yakima-Kennewick	Chandler	1955	0	12,000	0	2-6,000.
3. Wyoming	Missouri River Basin	Fremont Canyon	1961	0	48,000	0	2-24,000.
4. Wyoming	do	Glendo	1959	0	24,000	0	2-12,000.
Subtotal C.				0	198,000		

D. UNDER CONSTRUCTION BY OTHERS—POWER TO BE MARKETED BY BUREAU OF RECLAMATION

1. North Dakota	Missouri River Basin (USOE)	Garrison	1955	0	400,000	0	5-80,000.
2. South Dakota	do	Gavins Point	1956	0	100,000	0	3-33,333.
3. South Dakota	do	Oahe	1961	0	425,000	0	5-85,000.
Subtotal D.				0	925,000		

E. AUTHORIZED TO BE CONSTRUCTED BY BUREAU OF RECLAMATION

	Central Valley		1961	0	2,000	0	1-2,000.
1. California	Lewiston			0	2,000	0	3-25,000.
2. California	Matheson		1961	0	75,000	0	3-22,000.
3. California	do		1961	0	66,000	0	4-22,500.
4. California	do		1963	0	90,000	0	1-5,500.
5. Colorado	Collbran		1959	0	5,500	0	1-2,500.
6. Colorado	do		1960	0	2,500	0	1-4,500.
7. Colorado	Colorado-Big Thompson		1958	0	4,500	0	3-10,000.
8. Idaho	Minidoka		1959	0	30,000	0	3-16,667.
9. Montana	Missouri River Basin		1970	0	50,000	0	2-800.
10. Montana	do		1970	0	1,600	0	3-6,000.
11. Montana	do		1970	0	18,000	0	3-8,000.
12. Montana	do		1963	0	24,000	0	2-4,000.
13. Montana	do		1970	0	8,000	0	2-10,000.
14. Montana	do		1958	0	20,000	0	3-667.
15. Montana	do		1965	0	2,000	0	4-50,000.
16. Montana	do		1961	0	200,000	0	1-2,600.
17. Nebraska	Davis Creek No. 1		1965	0	2,600	0	1-6,500.
18. Nebraska	Davis Creek No. 2		1966	0	11,000	0	1-6,100.
19. Nebraska	do		1967	0	6,100	0	2-2,200.
20. Nebraska	Lillian		1966	0	4,400	0	2-5,000.
21. Oregon	Talent		1966	0	10,000	0	4-45,000.
22. South Dakota	Missouri River Basin		1966	0	180,000	0	2-2,000.
23. Utah	do		1957	0	4,000	0	1-1,400.
24. Utah	do		1967	0	1,400	0	2-2,500.
25. Utah	Provo River Basin		1957	0	5,000	0	3-7,667.
26. Washington	Yakima-Roza division		1938	0	11,250	0	2-7,200.
27. Wyoming	Missouri River Basin		1963	0	23,000	0	2-12,500.
28. Wyoming	Bald Ridge		1964	0	14,400	0	2-7,450.
29. Wyoming	Hunter Mountain		1964	0	25,000	0	3-41,734.
30. Wyoming	Sheridan		1964	0	14,900	0	
31. Wyoming	Sunlight		1965	0	125,200	0	
	Thief Creek			0	1,037,350	0	
				0			
	Subtotal E			0			

F. AUTHORIZED TO BE CONSTRUCTED BY OTHERS—POWER TO BE MARKED BY BUREAU OF RECLAMATION

	Central Valley (USCE)-----	Iron Canyon-----			
	Missouri River Basin (USCE)	Big Bend			
1. California-----			0	54,000	0
2. South Dakota-----			0	120,000	0
Subtotal F-----			0	174,000	0
Total-----			5,211,050	7,931,400	

¹ Acquired from city of Anchorage for operation with Eklutna project, fiscal year 1955

2 Powerplant units operated by power allottees under agency contract.

³ Leased to Public Service Co. of Colorado for operation.

USCE—United States Corps of Engineers.
IBWC—International Boundary and Water Commission.

Transmission Lines

On June 30, 1955, the Bureau of Reclamation's transmission system consisted of 9,069 circuit miles of line. During fiscal year 1955, 321 circuit miles of transmission lines were completed to serve load centers where other trunk transmission facilities were not available. These are shown in table 9.

TABLE 9.—*Transmission lines completed during fiscal year 1955*

Project and line	Voltage (kilovolts)	In-service date	Circuit miles
Missouri River Basin project:			
Fort Randall powerplant to Sioux City.....	230	April 1955.....	122.0
Oahe Temporary substation to Bismarck.....	230	May 1955.....	171.9
Central Valley project:			
Folsom powerplant to Elverta terminal.....	230	April 1955.....	20.2
Nimbus powerplant to Folsom switchyard.....	115	April 1955.....	7.0
Total.....			321.1

Power Contracts

During fiscal year 1955, there were 137 contracts executed for the delivery of electric power supply. A number of these were renewals of operating contracts or revisions of existing contracts resulting from changed operating conditions. Included are:

Number of contracts:

- 20 with private utilities.
- 39 with REA cooperatives.
- 47 with municipalities.
- 6 with other Federal agencies.
- 13 with public power districts.
- 9 with State authorities.
- 1 with irrigation district.
- 2 miscellaneous type contracts.

The Bureau continued its policy of contracting whenever possible with private utilities, public bodies and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with its customers.

A summary by classification of customers served by Reclamation during fiscal year 1955 is shown in table 10.

The Bureau at the end of fiscal year 1955 had 136 contracts under active negotiation. This included 26 contracts with municipalities, 70 with REA cooperatives, 21 with private utilities, 2 with public power districts, 10 with other Federal agencies, 3 with State authorities, 2 with irrigation districts and 2 miscellaneous type contracts. A number of these are to renew the existing contracts, or to revise contracts in existence due to changes in operating conditions.

TABLE 10.—*Summary by classification of customers for 12 months ending June 30, 1955*¹

Type of customers	Number of customers	Sales of electric energy kilowatt-hours	Revenue from sales of electric energy
Privately owned utilities.....	32	2, 648, 229, 566	\$9, 147, 237. 97
Municipal utilities.....	51	1, 355, 926, 872	4, 130, 373. 72
State government utilities.....	12	3, 347, 446, 302	11, 632, 360. 84
Cooperative utilities (Rural Electrification Administration projects).....	112	885, 960, 407	5, 251, 501. 80
Other Federal utilities ²	5	14, 654, 182, 022	16, 306, 978. 86
Residential and domestic.....	301	4, 876, 804	27, 215. 79
Rural (other than Rural Electrification Administration projects).....	7	175, 400	1, 174. 73
Commercial and industrial.....	24	86, 281, 369	445, 713. 54
Public authorities.....	62	1, 059, 613, 131	3, 602, 787. 34
Interdepartmental.....	42	988, 633, 735	1, 218, 911. 89
Total, all customers.....	648	25, 031, 325, 608	51, 764, 256. 48

¹ Does not include energy sales and revenues in transactions between Bureau projects.

² Totals include 14,573,567,701 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$15,956,430 in payments by that agency.

PROJECT DEVELOPMENT DIVISION

The project development program provides for the investigation of plans for potential projects for the utilization of the water resources of the West for irrigation and for other purposes and for advance planning on newly authorized projects awaiting the initial construction funds.

Comprehensive Basin Surveys

During fiscal year 1955, the Bureau of Reclamation continued the Arkansas-White-Red River Basin survey in cooperation with other interested Federal agencies under the field committee established by the Federal Inter-Agency River Basin Committee on June 12, 1950. By the end of the fiscal year the field work had been practically completed and work was under way on the preparation and review of the comprehensive report with the objective of completing all work early in fiscal year 1956.

Several other basin surveys also were under way but by the end of the fiscal year none had been completed.

New Projects Authorized

During fiscal year 1955, the following projects were authorized by acts of Congress:

- Chief Joseph Dam project, Foster Creek Division, Washington.
- Deschutes project, North Unit, Haystack equalizing reservoir, Oregon.
- Michaud Flats project, Idaho.
- Palo Verde diversion project, Arizon-California.

Rogue River Basin project. Talent division and rehabilitation of Medford and Rogue River Valley irrigation district, Oregon.

Santa Margarita project, California.

Santa Maria project, California.

The 1955 Interior Department Appropriation Act provided funds for the start of construction on the Alamogordo Dam spillway enlargement of the Carlsbad project in New Mexico and the Crescent Lake Dam project, Oregon.

The Glendo unit of the Missouri River Basin project was reauthorized by a joint resolution of Congress based on a report submitted in accordance with special provisions of recent Interior Department appropriation acts. Legislation was also passed by Congress to authorize the Ainsworth, Lavaca Flats, Mirage Flats Extension and O'Neill units in the Niobrara River Basin in Nebraska as integral units of the Missouri River Basin project.

Project Planning Reports and Authorizing Legislation

By the end of the fiscal year reports had been submitted to Congress and ordered to be printed as congressional documents for the Juniper division of the Wapinitia project in Oregon and for the Washoe project in California and Nevada. In addition, planning reports for the Crooked River project in Oregon and the McMillan Delta Water Salvage Channel in the Pecos River Basin in New Mexico and a supplemental report on the Trinity River division of the Central Valley project in California were completed and submitted to the interested States and Federal agencies for review. A report was also completed and under review by the end of the fiscal year by affected States and Federal agencies for the Ainsworth unit of the Missouri River Basin project in anticipation of its being submitted to Congress as a basis for approval of construction as required by the authorizing legislation for this unit. A feasibility report on the Ventura River project in California had been submitted to the President and was under review by the Bureau of the Budget by the end of the fiscal year.

During the year bills were considered in Congress to provide permanent authorization for the Bureau's investigation program in Alaska, which in the past had been undertaken on a year-to-year basis based on special language in the annual Department of the Interior appropriation acts, and to authorize construction of the Trinity River division of the Central Valley project in California. Both bills became law by congressional passage and Presidential signature shortly after the end of the 1955 fiscal year.

Bills were introduced to authorize the following projects and hearings were held in both Houses of Congress: The Colorado River

storage project and participating projects in Arizona, Colorado, New Mexico, Wyoming, and Utah; the Fryingpan-Arkansas project in Colorado; the Ventura River project in California; and the Washita Basin project in Oklahoma. Of these, the bills for the Colorado River storage project and participating projects and the Washita Basin project were passed by the Senate. A bill was also introduced in both Houses for authorization of the Hells Canyon project in Idaho and Oregon.

Definite Plan Reports

During the fiscal year, definite plan reports were prepared, reviewed and approved for the following projects:

Avondale project, Idaho.

Carlsbad project, Alamogordo Dam spillway enlargement, New Mexico.

Crescent Lake Dam project, Oregon.

Deschutes project, north unit, Haystack equalizing reservoir, Oregon.

River Compacts

The consent of the Congress was given to the Sabine River compact between Texas and Louisiana.

The Bear River compact was signed by the compact commissioners and submitted to the State legislatures of Utah, Wyoming, and Idaho for ratification.

The Columbia River compact was reviewed and comments on the proposed compact and draft of the Federal representative's report were furnished through the Secretary of the Interior to the Federal representative. The compact was approved by the Columbia Interstate Compact Commission and submitted to the State legislatures of Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada for ratification.

Comments were furnished to the Secretary of the Interior on proposed bills granting consent of the Congress to negotiation of compacts between the States of California and Oregon regarding the Klamath River; between Oklahoma and Arkansas and between Oklahoma and Kansas regarding the Arkansas River; between the 10 Missouri River Basin States regarding the Missouri River; between California and Nevada regarding the Carson, Truckee, and Walker Rivers; and Arkansas, Louisiana, Oklahoma, and Texas regarding the Red River.

Hydrologic services in connection with interstate compacts were also rendered during the year. These services included advice to the Upper Colorado River Commission and to the Columbia Interstate Compact Commission.

International Stream Investigations

The Bureau of Reclamation was represented on International Engineering Boards of the United States section of the International Joint Commission. The Boards continued their engineering studies for use of the Commission in its consideration of the Waterton-Belly and Souris-Red Rivers references of January 12, 1948. These references concern the apportionment of the waters of those international streams between the United States and Canada. The Souris-Red Rivers Engineering Board submitted to the Commission its report with respect to the Souris River under items 1, 2, and 3 of that reference.

Hydrology

Development of improved technical procedures applicable to basic hydrologic investigations of proposed reclamation projects was accomplished in the field of sediment, flood control, water resources, and forecasting of stream flow.

A report on a method of estimating the magnitude and occurrence of return flow from irrigated areas was completed. While this method was developed primarily for use in stable channel design, it will be useful also in other types of engineering analysis. Considerable progress was made also in the refinement of methods for determining total sediment transport capacity of natural and artificial channels and for computing the characteristics of stable artificial channels.

Field and office work was continued during the year on major storms that have occurred in the 17 Western States. These storm data provide the basis for determination of design storms for reclamation structures. Work was continued on the development and refinement of methods for the hydrographic analysis of flood flows produced by snowmelt or a combination of rain and snowmelt in pervious mountain areas.

Irrigation water requirement experimental data, collected and published by other agencies, were compiled and studied with the eventual goal of developing more accurate methods of estimating irrigation requirements for planning studies.

A method for determining the monthly gross evaporation loss from Lake Mead was developed and is currently being used in routine reservoir operations. Development of a method for short-term rate-of-inflow forecasts, based on the recession concept, was prepared to assist flood control operation of Shasta Lake. Progress continued on the development of methods for computation of both seasonal water-yield and rate-of-runoff forecasts.

Extensive work was performed in connection with development and review of hydrologic studies for foreign projects in Australia, Ethiopia, Lebanon, Thailand, Formosa, and the Philippine Islands.

DIVISION OF PROGRAM COORDINATION AND FINANCE

Financial Operations

Under the reorganization plan of the Bureau of Reclamation the regional directors were vested with increased responsibility for executing financial procedures and acting on audit and other reports which disclosed deficiencies in the regional functions. A plan was developed to delegate to regional field accounting units the role of performing the work associated with this responsibility.

The reorganization of the Solicitor's office of the Department necessitated a change in procedures for financing the operations of that office. Instructions were formulated whereby reclamation offices will be reimbursed for the miscellaneous services and supplies provided to the Solicitor's field and regional offices.

Necessary accounting procedures were developed to implement the revised policy of the Bureau in transferring property between reclamation projects to other Interior agencies and to water users organizations. The objective of the revised policy is to affect a greater utilization of reclamation property and to establish appropriate accountability in the financial records.

The relation of Bureau of Reclamation accounting to proposed Civil Service Commission standards for the classification of professional accountants was given attention during the fiscal year. Revisions in the proposed standards and justifications were transmitted to the Civil Service Commission in order to assure personnel of a desirable professional level and competency for the performance of reclamation accounting.

Statistics

Statistics activity during the year included developing, maintaining and furnishing central statistical service on items such as project feasibilities and authorizations, Reclamation Fund, appropriations and allotments, investments and expenditures, costs, revenues, cost allocations and repayments, operating programs, status and utilization of funds and employment and personal services.

It also involved preparation of the Bureau's Monthly Activities Report and quarterly Progress Report, publication of a Statistical Appendix to the Annual Report of the Commissioner, and compila-

tion and processing of reports on financial operations, program accomplishments and other data. Continuing review of operations resulted in the elimination of unnecessary reports in the interest of economy and efficiency.

Schedules

Procedures governing the integrated system of estimating, programming, reporting and accounting in use by the Bureau were revised and simplified. Studies by special committees of the construction and operation and maintenance schedules resulted in the elimination of unessential details reducing the size of the program documents and conserving filing and storage space.

The revised scheduling procedures and forms were first used in the preparation of preliminary estimates for fiscal year 1957. While minor revisions may be necessary, it is already apparent that the new procedure will result in a considerable saving of time and labor.

It is gratifying to note that the procedures now in use by the Bureau of Reclamation are, in general, very closely in conformance with the recommendations of the Commission on Organization of the Executive Branch of the Government in its report on "Budget and Accounting" dated June 1955. Experience with this system has indicated that it lends itself most readily to an integrated procedure whereby estimates, schedules, reports, and accounts can be related to each other and at the same time provide meaningful information as to progress of activities.

Budget

Appropriations made available to the Bureau of Reclamation for fiscal year 1955 totaled \$163,207,000 including \$831,570, later transferred to the Solicitor's office of the Department, leaving a net appropriation of \$162,375,430. This did not include \$3,865,329 in permanent appropriations. The appropriation represents an increase of \$19,537,340 over the appropriation for fiscal year 1954.

With an unobligated balance of 9.1 million plus funds advanced by water users, trust funds, a continuing fund for emergency expenses, Fort Peck project and working funds, the money available for reclamation was \$175.7 million. Of this amount, however, \$1.7 million was rescinded, \$6.5 million was placed in budgetary reserve, and \$2 million was scheduled for obligation in future years, leaving a net amount programed of \$165.5 million. Of this amount there remained unobligated at the close of 1955 funds in the amount of \$11.8 million.

Obligations for fiscal year 1955 totaled 155.6 million or 94 percent of the obligations programed as compared with 96.3 percent of the program accomplished in 1954.

The 1955 Appropriation Act, included certain restrictions upon the Bureau. The Bureau was directed not to initiate construction on transmission facilities in areas covered by power wheeling contracts unless the power companies in such areas were unable or unwilling to construct the facilities.

The limitation on the amount of money which may be expended for work by Government forces (force account work) was included again in the 1955 act. This limitation provided that not to exceed 12 per cent of the allotment for any one project or unit of the Missouri River Basin project, with a maximum of \$225,000 for any such project or unit, was to be so used. Also again as in recent years a limitation was placed upon the amount of money that could be expended for information services. By administrative determination this limitation was placed at \$17,300.

The amounts appropriated by activity for fiscal year 1955, together with the amounts to be derived from the special and general funds, follow:

TABLE 11.—*Condensed statement of appropriations, fiscal year 1955 exclusive of trust funds and permanent appropriations*

General investigations	\$3, 750, 000
Reclamation fund	(3, 150, 000)
Colorado River Dam fund, Colorado River Development fund...	(500, 000)
General fund	(100, 000)
Construction and rehabilitation.....	133, 757, 000
Reclamation fund.....	(57, 946, 197)
General fund.....	(75, 810, 803)
Operation and maintenance.....	21, 500, 000
Reclamation fund.....	(18, 257, 222)
Colorado River Dam fund.....	(1, 942, 778)
General fund.....	(1, 300, 000)
General administrative fund.....	4, 000, 000
Reclamation fund.....	(4, 000, 000)
Emergency fund	200, 000
Reclamation fund.....	(200, 000)
Grand total.....	163, 207, 000
Reclamation fund.....	(83, 553, 419)
Colorado River Dam fund.....	(2, 442, 778)
General fund.....	(77, 210, 803)

TABLE 12.—*Annual appropriations from Reclamation and other funds, fiscal years 1902–55*

Fiscal year	Reclamation fund ¹	General fund	Colorado River Dam fund	Emergency relief funds ²	Fort Peck continuing fund	Permanent appropriations	Total
1902.....	³ \$165,000						(²)
1903.....	³ 5,950,000						(³)
1904.....	³ 18,440,000						³ \$2,000,000
1905.....	³ 8,758,000						(³)
1906.....	³ 24,894,961						³ 15,363,800
1907.....	³ 41,979,161						(³)
1907.....	19,186,161						³ 18,051,161
1908.....	9,526,038						9,562,038
1909.....	9,180,700						9,180,700
1910.....	8,183,300						8,183,300
1911.....	26,896,790						26,896,790
1912.....	8,262,367						8,262,367
1913.....	8,300,508						8,300,508
1914.....	15,931,922						15,931,922
1915.....	1,261,411						1,261,411
1916.....	13,530,000						13,530,000
1917.....	8,887,557	\$15,000					8,902,557
1918.....	8,227,000	310,213					8,537,213
1919.....	9,397,081	443,196					9,840,277
1920.....	7,300,000	548,927					7,848,927
1921.....	8,463,000	661,177					9,124,177
1922.....	20,266,000	335,871					20,601,871
1923.....	14,800,000	559,530					15,359,530
1924.....	13,800,000	314,067					14,114,067
1925.....	11,890,809						11,890,809
1926.....	12,563,240	687,336					13,250,576
1927.....	7,436,320	75,000					7,511,320
1928.....	12,148,800	122,640					12,271,440
1929.....	14,328,400	115,000					14,443,400
1930.....	8,643,000	10,760,000					19,403,000
1931.....	9,482,000	100,000					9,582,000
1932.....	7,271,000	25,100,000					32,371,000
1933.....	2,817,288	13,050,000					15,867,288
1934.....	3,408,000	8,048,000		\$103,535,000			114,991,000
1935.....	1,176,750			34,076,000			35,252,750
1936.....	1,388,100	15,950,000		25,438,000			42,776,100
1937.....	12,344,600	34,850,000	\$350,000	⁴ 4,873,000			42,671,600
1938.....	12,322,600	30,570,000	500,000	37,047,500		\$1,100,000	81,540,100
1939.....	10,940,600	32,995,000	500,000	⁴ 2,502,488		4,600,000	46,533,112
1940.....	13,875,600	64,215,000	575,000	28,347		5,700,000	84,393,947
1941.....	10,000,600	63,260,000	768,000	⁴ 124,300		6,600,000	80,504,300
1942.....	8,111,000	92,862,031	1,000,000	⁴ 19,961		2,600,000	104,553,070
1943.....	3,607,960	86,745,460	1,379,250	⁴ 1,131		2,600,000	94,331,539
1944.....	4,514,475	35,712,000	1,443,100	⁴ 72,709	\$300,000	5,600,000	47,496,866
1945.....	7,649,800	18,637,200	2,200,000	⁴ 22,332	100,000	13,100,000	41,664,668
1946.....	36,617,890	83,527,750	2,550,000		200,000	4,856,302	127,751,942
1947.....	39,600,213	75,901,805	1,814,330	⁴ 30,396		4,600,000	121,885,952
1948.....	25,676,750	115,505,288	2,088,000		308,000	5,280,000	148,858,038
1949.....	36,952,264	227,636,453	2,450,000		355,000	4,440,000	271,833,717
1950.....	44,759,817	312,269,875	2,123,100		403,229	7,641,440	367,197,461
1951.....	46,917,165	222,453,635	2,308,000		358,605	5,738,210	277,775,615
1952.....	51,422,347	180,665,175	2,171,000		1,044,995	6,621,607	241,925,124
1953.....	72,945,450	130,859,541	2,643,000		639,950	7,743,965	214,831,906
1954.....	74,884,496	65,505,454	2,679,710		648,783	4,610,748	148,329,191
1955.....	83,553,419	75,444,114	2,442,778		803,218	5,953,500	168,197,029
Total..	916,915,388	2,026,811,738	31,985,268	192,478,530	5,161,780	⁵ 99,385,772	3,272,738,476

¹ Prior to fiscal year 1916 funds were made available to Reclamation Service by allotments from the reclamation fund, authorized by the Secretary of the Interior.

² Emergency relief funds include allocations to reclamation from NIRA, PWA, and ERA funds.

³ Allotments made prior to Fallon, Nevada Conference on July 27, 1907, were canceled and summary allotments issued. Original amounts excluded from total column.

⁴ Credit.

⁵ Repayment of advances included: Boulder Canyon, \$21,634,120; and All-American Canal system, \$2,752,000.

TABLE 13.—*The Reclamation fund, fiscal years 1954-56, funds available for appropriation*

Receipts and appropriations	Actual, 1954	Actual, 1955	Estimated, 1956
Unappropriated balance brought forward (as of June 30).....	\$78, 234, 264	\$88, 033, 071	\$92, 751, 703
Add items in transit.....			37, 705
Accretions and collections:			
Bureau of Reclamation and other agencies, (.100).....	14, 276, 770	16, 014, 551	14, 600, 000
Other agencies, (.200).....	27, 943, 980	32, 282, 541	37, 778, 200
Power revenues, (.300).....	41, 578, 238	38, 462, 092	47, 800, 000
Subtotal, accretions and collections.....	83, 798, 988	86, 759, 184	100, 178, 200
Lapsed appropriations.....	995, 063	1, 666, 367	1, 080, 000
Total available for appropriation.....	163, 028, 315	176, 458, 622	194, 047, 608
Less permanently authorized appropriations for:			
Refund of revenue collections.....	100, 000	150, 000	
Farmers irrigation district, North Platte project, Nebraska.....	10, 748	3, 500	8, 000
Deduct annual appropriation or estimate for:			
General investigations.....	2, 400, 000	3, 150, 000	4, 421, 812
Construction and rehabilitation.....	52, 509, 206	57, 946, 197	69, 287, 000
Operation and maintenance.....	15, 975, 290	18, 257, 222	20, 223, 638
General administrative expenses.....	4, 500, 000	4, 000, 000	3, 600, 000
Emergency fund.....	400, 000	200, 000	500, 000
Subtotal, annual appropriation or estimate.....	74, 884, 496	83, 553, 419	98, 032, 450
Balance carried forward.....	88, 033, 071	92, 751, 703	96, 007, 158

¹ Includes the amount of \$1,282,095.90 transferred from (.200); and additional collections made by other agencies during fiscal year 1955.

TABLE 14.—*Accretions to Reclamation Fund by States, fiscal year 1955*

State or other accretions	Sale of public land		Proceeds from Oil Leasing Act		Total to June 30 1955
	Fiscal year 1955	To June 30, 1955	Fiscal year 1955	To June 30, 1955	
Alabama.....			\$5, 043. 94	\$208, 910. 66	\$208, 910. 66
Arizona.....	\$78, 929. 78	\$3, 063, 339. 94	74, 783. 98	346, 203. 02	3, 409, 542. 96
Arkansas.....			7, 977. 76	19, 354. 29	19, 354. 29
California.....	533, 672. 47	10, 351, 841. 85	5, 172, 964. 60	61, 011, 140. 81	71, 362, 982. 66
Colorado.....	167, 710. 23	11, 067, 155. 43	4, 394, 497. 10	25, 071, 385. 62	36, 138, 541. 05
Florida.....			79. 67	1, 937. 64	1, 937. 64
Idaho.....	170, 381. 35	7, 960, 849. 82	63, 980. 98	560, 477. 12	8, 521, 326. 94
Illinois.....				42. 00	42. 00
Kansas.....	4, 013. 99	1, 045, 543. 42	46, 713. 05	342, 135. 93	1, 387, 679. 35
Louisiana.....			53, 423. 40	588, 411. 17	588, 411. 17
Michigan.....			2, 768. 65	25, 646. 87	25, 646. 87
Mississippi.....			2, 946. 50	13, 880. 41	13, 880. 41
Montana.....	207, 072. 99	16, 089, 165. 98	1, 146, 941. 62	9, 791, 884. 12	25, 881, 050. 10
Nebraska.....	11, 242. 34	2, 209, 980. 44	4, 037. 38	52, 480. 51	2, 262, 460. 95
Nevada.....	58, 026. 92	1, 207, 979. 39	775, 837. 61	2, 232, 551. 79	3, 440, 531. 18
New Mexico.....	63, 944. 20	7, 192, 567. 99	4, 375, 588. 96	30, 687, 018. 54	37, 879, 586. 53
North Dakota.....	5, 742. 27	12, 274, 371. 05	59, 155. 73	680, 786. 56	12, 955, 157. 61
Oklahoma.....	284. 46	5, 968, 809. 70	25, 893. 83	196, 276. 93	6, 165, 086. 63
Oregon.....	694, 011. 33	14, 571, 542. 67	60, 112. 28	107, 295. 99	14, 678, 838. 66
South Dakota.....	22, 877. 49	7, 795, 935. 54	134, 561. 27	485, 115. 50	8, 281, 051. 04
Utah.....	86, 937. 53	4, 802, 097. 93	2, 036, 389. 45	9, 600, 068. 90	14, 402, 166. 83
Washington.....	209, 971. 49	8, 545, 684. 30	2, 940. 53	62, 340. 32	8, 608, 024. 62
Wyoming.....	63, 695. 27	9, 342, 692. 63	11, 201, 713. 82	103, 083, 558. 48	112, 426, 251. 11
Total.....	2, 378, 514. 11	123, 489, 558. 08	29, 648, 352. 11	245, 168, 903. 18	368, 658, 461. 26

OTHER ACCRETIONS

	Fiscal year 1955	Total to June 30, 1955
Proceeds, Federal water power licenses.....	\$71, 009. 66	\$1, 414, 619. 72
Proceeds, Potassium royalties and rentals.....	1, 380, 515. 49	9, 269, 633. 17
Receipts from naval petroleum reserves, 1920-38, act of May 9, 1938.....		29, 778, 300. 23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919.....	264. 67	11, 637. 19
Lease of lands.....	(1)	
Townlot sales.....		
Timber sales, and other miscellaneous items.....		
Miscellaneous items, other.....		5. 78
Total.....	1, 451, 789. 82	40, 474, 196. 09
Grand total.....	33, 478, 656. 044	409, 132, 657. 35

¹ The amount of \$1,196,115.20 plus collections made by other agencies during fiscal year 1955, \$85,980.70, totaling \$1,282,095.90, were transferred to (.100), for project recording purposes.

TABLE 15.—*Cost of plant, property and equipment, by States, June 30, 1955*

State and project	Completed works					Construc- tion in progress	Other physical property	Total
	Multi- purpose (1)	Irrigation (2)	Electric (3)	Municipal water (4)	Flood control (5)			
Total.....	\$987,186,637	\$779,557,805	\$574,671,487	\$14,041,384	\$13,319,716	\$285,583,593	\$20,746,915	\$2,675,107,537
Alaska: Eklutna.....			32,374,304					32,374,304
Arizona, subtotal.....	90,417,683	50,482,203	104,095,356		3,454,724	14,861,062	109,394	263,420,322
Boulder Canyon: All-American Canal system (California) Hoover Dam and powerplant (Nevada) Colorado River front work and levee system (Cal- ifornia-Nevada).....	2,179,950 44,545,300		33,554,931			242,327		2,179,950 78,342,558
Gila Parker-Davis (California-Nevada) Salt River Yuma (California) Yuma auxiliary.....	38,467,443 5,224,890	35,209,534 10,753,356 3,844,931 614,382	95,100 66,086,373 4,266,443 92,509		3,454,724	22,317 4,894,123 4,601,823 5,046,969 166 53,337	109,394	3,477,041 40,368,151 109,155,639 25,291,658 3,937,606 667,719
California, subtotal.....	291,518,660	126,446,570	86,182,274		9,477,000	74,491,249	4,055,177	592,170,930
Boulder Canyon: All-American Canal system (Cal- ifornia) Cachuma Central Valley Colorado River front work and levee system (Arizona- Nevada) Klamath (Oregon) Orland Parker-Davis (Arizona-Nevada) Solano Truckee storage (Nevada) Yuma (Arizona).....	38,459,336 22,199,273 225,437,946	16,526,315 98,141,131	45,091 67,437,513		3,329,786	79,435 19,489,739 47,307,173		58,439,963 41,689,012 442,378,940
		6,303,654 2,623,901	18,197,820		6,147,214	121,564 54,456		6,268,778 6,358,110 2,623,901
	5,422,105					371,233		23,991,180
		2,851,569	501,850			7,066,966		7,066,966
						681		3,354,100
Colorado, subtotal.....	53,403,787	103,814,347	42,221,452			2,071,845		201,511,431
Colorado-Big Thompson Fruitgrowers Dam Grand Valley Mancos Missouri River Basin.....	36,260,659	78,836,350 200,309 6,867,055 3,895,150	41,559,484 213,669			43,698		156,720,191 200,309 7,080,724 3,895,150 14,751,088
	13,273,698		448,299			1,029,281		

Paonia.....	1,576,054	33,479,611	9,132,087	1,020,096	10,851	1,595,905
Pine River.....	3,453,470				2,403	3,455,873
San Luis Valley.....					976,612	4,846,232
Uncompahgre.....	8,995,959					8,995,959
Idaho, subtotal.....	33,479,611	9,132,087	1,020,096	43,187,401		137,666,755
Avondale.....					238,277	238,277
Boise (Oregon).....	16,222,566		6,425,600		33,511	64,401,833
Dalton Gardens.....					268,438	268,438
King Hill.....	1,877,732					1,877,732
Lewiston Orchards.....	1,037,302			1,020,096		2,484,397
Minidoka (Wyoming).....	12,507,351		2,706,487		1,707,361	25,621,604
Owyhee (Oregon).....	902,000				176	25,902,176
Paiynee (Oregon).....					40,949,638	40,949,638
Palsades (Wyoming).....	450,300					450,300
Preston Bench.....	452,360					452,360
Rathdrum Prairie.....						
Iowa: Missouri River Basin Transmission Lines.....	4,092,213	970,606	28,205,937	28,205,937	334,475	41,894,544
Kansas, subtotal.....	334,475	28,205,937	102,288	25,318,904	196,503,062	1,023,141
Garden City.....					68,090	4,568,720
Missouri River Basin.....	334,475				271,844	9,847,983
Minnesota: Missouri River Basin Transmission Lines.....	290,797	9,575,127	272,866	160,748	101,456,480	290,797
Montana, subtotal.....	32,006,770	39,787,674	1,562,159	3,077,537	1,562,159	1,562,159
Bitter Root.....	955,051				32,371	3,077,537
Buffalo Rapids.....	4,296,876				9,739,179	9,739,179
Fort Peck (North Dakota).....					278,322	278,322
Frenchtown.....	290,797				54,454,668	54,454,668
Hungry Horse.....					16,400	16,400
Huntley.....					65,261	10,055,286
Inlake.....	1,562,159					
Lower Yellowstone (North Dakota).....	3,077,537					
Milk River.....	9,439,804					
Missoula Valley.....	2,017,428					
Missouri River Basin.....	16,400					
Shoshone (Wyoming).....	9,990,025					
Sun River.....						
Nebraska, subtotal.....	31,580,222	6,251,590	11,217,185	11,217,185	85,941,831	85,941,831
Mirage Flats.....	3,102,575					3,102,575
Missouri River Basin.....	19,523,717					73,536,138
North Platte (Wyoming).....	8,933,930					9,303,118

See footnotes at end of table.

Ochoce.....	18,217,520	18,239,249	21,729	18,239,249
Owyhee (Idaho).....	5,310,346	5,310,346	53,443	5,310,346
Umatilla.....	4,866,824	4,866,824	53,443	4,866,824
Vale.....	8,321,056	29,857,221	11,923,819	67,975,793
South Dakota, subtotal.....	17,820,254			
Relle Fourche.....	5,032,546		264	5,032,810
Missouri River Basin.....	3,288,510	29,857,221	11,923,555	62,017,080
Rapid Valley.....				923,903
Texas, subtotal.....	23,499,080	464,801	46,692	29,285,719
Balmorhea.....	407,741			407,741
Colorado River.....		464,801		23,963,881
Falcon Dam.....				4,914,097
Rio Grande (New Mexico).....	4,867,405			(1)
Rio Grande River rectification.....				
Utah, subtotal.....	15,153,509	91,969	10,682,729	58,556,372
Hyrum.....	953,854			953,854
Moon Lake.....	1,799,859			1,799,859
Newton.....	712,592			712,592
Ogden River.....	5,013,284			5,013,284
Provo River.....	3,768,627	12,869,262	243,333	32,034,731
Sanpete.....	433,940			433,940
Scorfield.....	943,837			943,837
Strawberry Valley.....	3,345,940	91,969		3,498,994
Weber Basin.....			10,439,396	10,439,396
Weber River.....	2,725,885			2,725,885
Washington, subtotal.....	165,954,998	108,404,200	41,969,788	536,100,481
Columbia Basin.....	161,510,003	107,081,493	32,724,663	480,364,794
Okanogan.....	1,484,324		22,153	1,506,477
Yakima.....	4,444,965	1,322,707	9,222,972	54,229,210
Wyoming, subtotal.....	45,993,106	47,624,533	9,193,638	160,302,188
Eden.....	3,785,846		835,424	4,621,270
Kendrick.....	9,637,574	14,766,194	469,161	30,035,272
Minidoka (Idaho).....	2,209,904			2,209,904
Missouri River Basin.....		27,723,596	6,509,455	66,962,765
North Platte (Nebraska).....	8,565,468	1,253,400	119,143	13,178,727
Palisades (Idaho).....			505,708	505,708
Riverton.....	2,970,469	463,953	1,011,725	21,472,080
Shoshone (Montana).....	1,890,664	3,417,390	1,374	21,316,462
Nonproject property.....	60			4,640,375

Note.—Name of State in which balance of project is located is indicated by parentheses. Irrigation plant listed at gross construction cost prior to deduction of chargeoffs authorized by Congress.

¹ Transferred to State Department.

TABLE 16.—*Repayment contracts—matured and unmatured—June 30, 1955*

Project and State	Value of repayment contracts			Unmatured charges				Repayment contracts matured	Due and unpaid
	Construction	Rehabilitation and betterment	Total	Construction water-right charges unmatured	Water-right charges deferred and unmatured	Rehabilitation and betterment charges unmatured	Total unmatured		
Arnold, Oreg.....	\$277,000.00	\$197,925.82	\$197,925.82	\$277,000.00		\$171,314.40	\$171,314.40	\$26,611.42	\$3,333.37
Avondale, Idaho.....	3,262,188.49	3,262,188.49	3,262,188.49	2,582,673.00			277,000.00	409,513.49	
W. C. Austin, Okla.....	225,014.54	225,014.54	225,014.54	98,084.54	\$20,193.25		118,277.79	106,736.75	
Baker, Oreg.....	255,600.00	255,600.00	255,600.00	236,347.50			236,347.50	19,252.50	
Balmorica, Tex.....	4,230,188.73	4,230,188.73	4,230,188.73	2,708,313.19			2,708,313.19	1,461,875.51	
Belle Fourche, S. Dak.....	952,741.05	100,000.00	1,052,741.05	592,010.07		100,000.00	692,010.07	300,730.98	
Bitler foot, Mont.....									
Boise, Idaho-Oreg.:									
Arrowrock division.....	13,682,811.30	13,682,811.30	13,682,811.30	2,583,167.02	1,028,512.58		3,611,679.60	10,071,131.70	33,767.90
Payette division.....	8,741,708.81	8,741,708.81	8,741,708.81	7,431,741.15	80,230.98		7,511,972.13	1,229,736.68	
Anderson Ranch Dam.....	5,146,511.01	5,146,511.01	5,146,511.01	4,052,599.13			4,052,599.13	493,911.88	80.00
Boulder Canyon, Ariz.-Calif.....									
All-American Canal system.....	52,395,638.05	52,395,638.05	52,395,638.05	52,201,179.75			52,201,179.75	194,478.30	
Buffalo Rapids, 1st division, Montana.....	930,000.00	930,000.00	930,000.00	916,700.00			916,700.00	13,300.00	6,650.00
Buffalo Rapids, 2d division, Montana.....	696,000.00	696,000.00	696,000.00	687,400.00			687,400.00	8,600.00	4,300.00
Burnt River, Oreg.....	599,735.00	599,735.00	599,735.00	359,828.08			359,828.08	239,906.92	
Cachuma, Calif.....	5,800,000.00	5,800,000.00	5,800,000.00	5,800,000.00			5,800,000.00		
Central Valley, Calif.....	3,741,760.67	25,000.00	3,766,760.67	1,922,098.66	64,070.00	25,000.00	2,011,168.66	1,755,592.01	
Colorado-Big Thompson, Colo.....	62,574,934.00	62,574,934.00	62,574,934.00	62,546,846.50			62,546,846.50	28,137.50	
Colorado River, Tex.....	26,031,000.00	26,031,000.00	26,031,000.00	26,030,000.00			26,030,000.00	1,000.00	
Columbia Basin, Wash.....	5,510,500.00	5,510,500.00	5,510,500.00	5,510,500.00			5,510,500.00		
Crescent Lake Dam, Oreg.....	87,547,376.96	87,547,376.96	87,547,376.96	87,499,270.79			87,499,270.79	48,106.17	
Dalton Gardens, Idaho.....	270,200.00	320,000.00	320,000.00	270,200.00		320,000.00	270,200.00		
Deschutes, Oreg.....	12,757,159.80	12,757,159.80	12,757,159.80	12,551,721.30			12,551,721.30	205,438.50	
Eden, Wyo.....	1,500,000.00	1,500,000.00	1,500,000.00	1,500,000.00			1,500,000.00		
Fort Sumner, N. Mex.....	2,432,166.55	2,432,166.55	2,432,166.55	2,371,962.39			2,371,962.39	60,804.16	
Frenchtown, Mont.....	297,282.04	297,282.04	297,282.04	242,826.63			242,826.63	54,755.41	
Fruitgroves Dam, Colo.....	198,240.71	198,240.71	198,240.71	149,345.43			149,345.43	48,895.28	
Gila, Ariz.....	42,475,000.00	42,475,000.00	42,475,000.00	42,467,083.31			42,467,083.31	7,916.66	
Grand Valley, Ariz.....	3,629,546.86	1,658,327.73	5,287,874.59	2,184,729.48	91,571.84	1,644,827.73	3,921,129.05	1,366,745.51	
Grants Pass, Oreg.....	1,211,244.68	950,000.00	950,000.00	779,761.62		942,500.00	942,500.00	7,500.00	
Humboldt, Nev.....	1,837,433.68	1,211,244.08	1,211,244.08	755,290.14	91,478.25		779,761.62	431,483.06	
Hyrum, Utah.....	944,046.36	1,837,433.68	1,837,433.68	687,282.00			687,282.00	990,665.29	
Intake, Mont.....	46,900.00	944,046.36	944,046.36	46,900.00			46,900.00	256,764.36	
Kendrick, W. yo.....	2,800,000.00	2,800,000.00	2,800,000.00	2,800,000.00			2,800,000.00	2,240.00	

Klamath, Oreg.-Calif.	4, 313, 501.07	40, 200.26	4, 353, 701.33	1, 279, 188.54	198, 335.54	38, 190.13	1, 515, 714.21	2, 837, 987.12	1, 103.59
Lewisville Orchards, Idaho.	2, 500, 000.00		2, 500, 000.00	2, 457, 535.72			2, 457, 535.72	42, 464.23	
Lower Yellowstone, Mont.-N. Dak.	4, 084, 366.39		4, 084, 366.39	1, 463, 976.68	381, 275.58		1, 854, 252.26	2, 239, 114.13	
Mancos, Colo.	900, 000.00		900, 000.00	885, 000.00			885, 000.00	15, 000.00	
Middle Rio Grande, N. Mex.	16, 533, 000.00		16, 533, 000.00	16, 533, 000.00			16, 533, 000.00		
Milk River, Mont.	7, 863, 624.89		7, 998, 375.89	6, 609, 625.11	45, 508.78	134, 851.00	6, 792, 984.89	1, 205, 391.00	12, 780.41
Mindoka, Idaho-Wyo.	20, 804, 625.02		20, 804, 625.02	5, 210, 073.99	120.37		5, 210, 194.36	15, 594, 330.66	
Mirage Flats, Nebr.	846, 300.00		846, 300.00	842, 300.00			842, 300.00	4, 000.00	
Missoula Valley, Mont.	45, 000.00		45, 000.00				45, 000.00		
Missouri Valley Basin:									
Boswicks division, Nebraska-Kansas	6, 605, 000.00		6, 605, 000.00				6, 605, 000.00		
Angostura unit, South Dakota	718, 000.00		718, 000.00				718, 000.00		
Frenchman-Cambridge division Ne-									
braska	2, 328, 800.00		2, 328, 800.00				2, 328, 800.00		
Fort Clark unit, North Dakota	66, 000.00		66, 000.00				66, 000.00		
Kirwin unit, Kansas	1, 500, 000.00		1, 500, 000.00				1, 500, 000.00		
Savage unit, Montana	143, 750.00		143, 750.00	143, 665.02			143, 665.02	84.98	
Sargent unit, Nebraska	1, 785, 400.00		1, 785, 400.00				1, 785, 400.00		
Hanover-Buff unit, Wyoming	672, 560.00		672, 560.00				672, 560.00		
Moon Lake, Utah	1, 892, 267.76		1, 892, 267.76	462, 552.88	95, 000.00		1, 114, 587.42	477, 080.34	
Newlands, Nev.	3, 257, 749.35		3, 257, 749.35	288, 750.00			557, 552.88	2, 700, 196.47	
Newton, Utah	350, 000.00		350, 000.00				288, 750.00	61, 250.00	
North Platte, Nebr.-Wyo.	20, 237, 552.74		23, 891, 638.39	4, 014, 803.50	90, 860.00	3, 573, 835.00	7, 709, 498.50	16, 182, 039.80	2, 102.16
Ochoco, Oreg.	4, 734, 935.11		500, 000.00			500, 000.00	500, 000.00		
Ogden River, Utah	468, 597.85		594, 597.85	3, 552, 682.88			3, 552, 682.88	1, 182, 252.23	
Okanagan, Wash.	2, 453, 522.15	128, 000.00	2, 748, 443.98	234, 597.57		128, 000.00	360, 597.57	234, 000.28	5, 606.49
Orland, Calif.	19, 826, 659.47	294, 921.83	19, 826, 659.47	731, 487.35	296, 940.33	217, 040.54	1, 245, 468.22	1, 502, 975.76	9, 945.87
Owyhee, Oreg.-Idaho	6, 403, 950.00		6, 403, 950.00	17, 766, 370.00			17, 766, 370.00	2, 060, 289.47	4, 904.55
Palisades, Idaho	2, 320, 000.00		2, 320, 000.00	6, 403, 950.00			6, 403, 950.00		
Paonia, Colo.	2, 320, 000.00		2, 320, 000.00	2, 320, 000.00			2, 320, 000.00		
Pine River, Colo.	1, 500, 000.00		1, 500, 000.00	1, 241, 680.00			1, 241, 680.00	258, 340.00	
Preston Bench, Idaho	1, 453, 000.00		1, 453, 000.00	453, 000.00			453, 000.00		
Provo River, Utah	19, 443, 650.00		19, 443, 650.00	19, 443, 650.00			19, 443, 650.00		
Rapid Valley, S. Dak.	1, 100, 000.00		1, 100, 000.00				1, 000, 000.00	100, 000.00	
Rathdrum Prairie, Idaho:									
Hayden Lake unit.	118, 409.19		118, 409.19	95, 531.23			95, 531.23	22, 877.96	
Post Falls unit.	190, 000.00		190, 000.00	161, 500.00			161, 500.00	28, 500.00	
Rio Grande, N. Mex.-Tex.	10, 144, 123.26		10, 144, 123.26	2, 789, 520.17	111, 592.41		2, 901, 112.95	7, 243, 010.68	
Riverston, Wyo.	7, 381, 827.26		7, 381, 827.26	6, 788, 288.76			6, 788, 288.76	593, 538.50	
Salt River, Ariz.	17, 482, 687.89	6, 010, 260.29	23, 492, 948.18	4, 909, 043.85	167, 796.90	5, 632, 172.58	10, 709, 013.33	12, 783, 934.85	
San Luis Valley, Colo.	2, 520, 000.00		2, 520, 000.00	2, 520, 000.00			2, 520, 000.00		
Sanpete, Utah	373, 375.94		373, 375.94	233, 150.25	2, 375.00		233, 525.25	137, 850.69	
Scofield, Utah	247, 000.00		247, 000.00	172, 800.00			172, 800.00	74, 200.00	
Shoshone, Wyo.-Mont.	6, 827, 609.52		7, 207, 609.52	4, 293, 778.98	6, 964.28	380, 000.00	4, 680, 743.26	2, 526, 866.26	
Strawberry Valley, Utah.	3, 349, 423.92		3, 349, 423.92	825, 018.74			825, 018.74	2, 524, 405.18	
Sun River, Mont.:									
Fort Shaw division	404, 771.91	40, 000.00	444, 771.91	74, 005.21		40, 000.00	114, 005.21	330, 766.70	
Greenfields division	9, 555, 084.41		9, 555, 084.41	8, 373, 814.24			8, 373, 814.24	1, 181, 270.17	
Truckee storage, Nev.	1, 000, 000.00		1, 000, 000.00	699, 660.42			699, 660.42	600, 339.58	
Tucumcari, N. Mex.	5, 901, 896.86		5, 901, 896.86	5, 886, 611.58			5, 886, 611.58	15, 285.28	

TABLE 16.—*Repayment contracts—matured and unmatured—June 30, 1955—Continued*

Project and State	Value of repayment contracts			Unmatured charges				Repayment contracts matured	Due and unpaid
	Construction	Rehabilitation and betterment	Total	Construction water-right charges unmatured	Water-right charges deferred and unmatured	Rehabilitation and betterment charges unmatured	Total unmatured		
Unatilla, Oreg.....	\$1,106,482.46	\$25,000.00	\$1,131,482.46	\$606,184.01	-----	\$25,000.00	\$631,184.01	\$500,298.45	\$7,813.12
Uncompahgre, Colo.....	6,874,017.36	-----	6,874,017.36	5,727,181.01	-----	-----	5,727,181.01	1,146,836.35	-----
Vale, Oreg.....	4,971,219.25	51,068.25	5,022,287.50	4,485,811.25	-----	51,068.25	4,536,879.50	485,408.00	-----
Vermejo, N. Mex.....	2,107,943.33	-----	2,107,943.33	2,107,943.33	-----	-----	2,107,943.33	-----	-----
Weber Basin, Utah.....	57,694,000.00	-----	57,694,000.00	57,694,000.00	-----	-----	57,694,000.00	-----	-----
Weber River, Utah.....	2,685,871.83	-----	2,685,871.83	970,121.94	-----	-----	970,121.94	1,715,749.89	-----
Yakima, Wash.:									
Kennewick division.....	4,809,700.00	-----	4,809,700.00	4,809,700.00	-----	-----	4,809,700.00	-----	-----
Kittitas division.....	11,225,652.54	-----	11,225,652.54	9,068,059.72	-----	-----	9,068,059.72	2,157,592.82	-----
Roza division.....	19,228,100.00	-----	19,228,100.00	18,402,824.35	-----	-----	18,402,824.35	825,275.65	-----
Storage division.....	3,600,134.12	719,262.47	4,319,396.59	780,799.25	-----	574,604.94	1,355,404.19	2,963,992.40	-----
Sunnyside division.....	4,187,005.84	-----	4,187,005.84	275,849.22	\$51,664.45	-----	327,513.67	3,859,492.17	-----
Tieton division.....	3,449,113.59	-----	3,449,113.59	-----	-----	-----	-----	3,449,113.59	-----
Yuma, Ariz.-Calif.....	5,604,305.50	-----	5,604,305.50	392,833.61	119,929.47	-----	512,763.08	5,091,542.42	156.12
Yuma auxiliary, Calif.....	884,033.97	-----	884,033.97	379,188.15	-----	-----	379,188.15	504,845.82	1,276.10
Grand total.....	702,775,461.04	15,226,803.30	718,002,264.34	583,496,159.64	2,947,420.01	14,496,404.57	600,939,984.22	117,062,280.12	94,755.76

COMPTROLLER

The program of internal audits and special assignments was intensified by the Comptroller to meet special requests from regional directors for financial data, and to assure that prescribed financial procedures and enunciated financial policies are being followed. Requests for specialized audit service in the field in connection with construction and operating activities reached an all-time high during the year.

Thirty-one field assignments were completed, including 12 financial audits of individual projects; 3 financial audits of water users' organizations; 10 special audits; and 6 audits of power and multipurpose operations of project units.

A financial audit and related cost allocation was performed for the Gila project, Arizona, to provide financial data required to support pending legislation and the negotiation of a contract for the repayment of construction costs.

A special audit and related cost allocation was also performed for the Garland division of the Shoshone project, Wyoming.

In connection with the Yakima project, Washington, a financial audit was performed as a preliminary to the completion of an official allocation of the costs of six reservoirs comprising the storage pool.

A financial audit and special report was completed for the Boulder Canyon project, Arizona-Nevada.

During the year internal audit performance placed emphasis on reviews of compliance with governing regulations, regular financial audits, and special work. A written audit program as a guide for examinations was published. A summary letter report now advises management of audit disclosures in advance of the audit report to facilitate remedial measures at the earliest time possible. A program of prompt issuance of audit reports established a current status in report production.

DIVISION OF ORGANIZATION AND METHODS

Secretarial delegations of authority to the Commissioner of Reclamation, and redelegations by the Commissioner to regional directors, were revised, simplified, and codified. Four brief documents replaced a large number of miscellaneous memoranda as well as 45 formal orders and numerous amendments thereto. The regions now have authority to act on a large number of routine matters which formerly required referral to Washington.

Bureau operating offices were closed to conform to the reduced workload at the following projects: All-American Canal, Calif.;

Dalton Gardens-Avondale, Idaho; Deschutes, Oreg.; and San Diego, Calif.

Under the Department's management improvement program the regions and divisions identified and initiated action to resolve 263 problems, the solution to which would improve the performance of the Bureau's work. Action was completed on about 75 percent of the problems scheduled for solution.

Under the broadened incentive awards program a total of 465 employee suggestions were evaluated during the year. Of these, 197, or 42.7 percent, were adopted. These improvements represented a tangible savings of over \$120,000 to the Bureau, and the employees who were responsible for the improvements were awarded \$6,430. Superior performance awards were granted to 37 employees for outstanding performance of duties.

Three employees received awards for special, specific contributions to Bureau operations which resulted in a savings of \$32,103. In addition to the total dollar savings from all phases of the incentive awards program of \$157,793, substantial intangible benefits were realized through improved working conditions and procedures, promotion of safety, and better employee morale.

DIVISION OF PERSONNEL

Bureau employment dropped from 10,349 full-time employees at the beginning of the year to 9,607 at the end. The decrease took place gradually as work was completed, and was largely accomplished by not filling vacancies although some necessary reduction-in-force action was carried out during the final months of 1954.

Because of the decrease in total employment only a limited amount of recruitment activity was necessary, and this was confined for the most part to lower-grade positions. The shortage of beginning engineers still continued and only a few of the vacancies in this category could be filled. Shortages also developed in certain subprofessional engineering categories. Bureau representatives visited various engineering colleges in the Western States during the year. Undergraduate engineering students were hired for summer work as student assistants and trainees.

The Central Board of Civil Service Examiners had examinations open for engineers, engineering aids, draftsmen, and construction inspectors. Three hundred and ninety-nine applications were processed and 126 placements made.

Reviews were made of classified and ungraded positions to transfer positions from the abolished crafts, protective, and custodial schedule to the general schedule and to place other positions under the wage

system, which were the new requirements set up by Public Law 763. Extensive position classification review also was performed throughout the Bureau and subsequent realignment of duties and responsibilities of position requirements accomplished. In the field of wage administration, new job definitions were developed and existing definitions modified; Wage Board hearings were held and rates adjusted to conform to prevailing area wages. Annual negotiations also were held on collective-bargaining agreements with respective unions and trades councils.

DIVISION OF PROCUREMENT AND PROPERTY MANAGEMENT

Under Budget Bureau and departmental policy guidance, all functions and activities of the Bureau providing goods and services for its own use were closely examined with a view toward obtaining such products from private enterprise wherever feasible.

Real and personal property no longer needed by this Bureau was offered to other agencies of the Department this year for the first time without reimbursement in order to encourage greater utilization within the Department of property purchased from appropriated funds. It was also decided during the year to make available without charge surplus property needed locally for public health and education purposes.

During the year the Bureau made a net disposal of 891 housing units, 20 percent of its housing, after deciding that private housing was able to provide sufficient accommodations in the affected locations.

Total procurement by purchase orders and contracts of the Bureau for fiscal year 1955 approximated \$14,698,000, compared with a volume of \$18,577,000 for the preceding fiscal year, a decrease of about 21 percent. However, the number of purchase actions increased approximately 7½ percent, from 65,207 in fiscal year 1954, to 70,159 in fiscal year 1955. A drop in dollar volume coincident with a rise in the number of procurement actions is not unusual during a period when numerous features are changed from a construction to an operation and maintenance status. Increased use of simplified purchase methods enabled the Bureau to make the transition smoothly, as evidenced by a reduction of 10 percent in the number of personnel engaged in purchasing activities.

Passenger-carrying vehicles of the Bureau fleet were reduced during fiscal year 1955 from 1,083 to 910. During the year the Bureau was authorized to replace 47 passenger-carrying vehicles. This meant that approximately 278 additional passenger-carrying vehicles which exceeded GSA replacement standards of 6 years and 60,000 miles

were operated by the Bureau. Due to the excessive age and mileage of a large part of the fleet, extreme care had to be exercised in order to maintain operating costs at a reasonable level.

Personal property with an original cost of \$2,429,675 was declared excess and sold for \$764,166, or 31.5 percent of cost. In fiscal year 1954 the original cost of property sold was \$2,585,169, which returned \$513,457, or 20 percent of cost. It is estimated that property with an original cost of about \$1,750,000 will become excess during the current fiscal year.

DIVISION OF GENERAL SERVICES

The Division of General Services administers records management, library operations, correspondence, communications, publications, printing and duplicating, travel services, space management and use, and other related functions.

New procedures for mail handling resulted in reduction in postage costs by extensive use of the new post office certified mail service instead of registered mail.

The Bureau Records Service Center at Denver was closed on July 23, 1954, and most of the records were transferred to the Federal Records Center there. A master set of all shelf lists for Bureau records sent to the Federal Records Center was established in the Commissioner's office, Denver, to aid the records staff of that office in research and reference service requested by Bureau offices.

The volume of reclamation records decreased this year from 124,300 cubic feet reported on June 30, 1954, to 123,000 cubic feet on June 30, 1955. Disposition for the year totaled 13,000 cubic feet and saved over \$100,000 in space and equipment. Total volume has decreased each year since 1952 when the coordinated records management program started and the volume reached a peak of 127,300 cubic feet.

Publications

A means of welding the publications activities in and out of Washington into an integrated Bureau program has been devised. The new program provides that, at the beginning of each fiscal year, all Bureau offices shall submit to Washington their plans for producing important publications in the field in addition to their plans for printing at the Government Printing Office in Washington, a requirement of long standing. These plans will be reviewed in Washington where the objectives will be, in addition to an integrated program in its editorial aspects, forestalled duplications and uniformly economical production practices in field printing.

Publications submitted to Washington and printed at the Government Printing Office during this fiscal year included the sixth edition of the Concrete Manual, prepared in the Commissioner's office in Denver; three congressional documents: Michaud Flats project, Idaho (H. D. 485); Canton project, North Canadian River Basin, Oklahoma (H. D. 445); and Talent division, Rogue River Basin project, Oregon (H. D. 450); the Commissioner's Annual Report to the Secretary for the Fiscal Year Ended June 30, 1954; the leaflet, Settlement Opportunities for 1955 on Reclamation Projects; and two editions of Committee Print No. 27, The Growth and Contribution of Federal Reclamation to an Expanding National Economy.

The following publications were submitted in the 1954 fiscal year and printed this fiscal year: The booklet, The Story of Hoover Dam; the folder, Hungry Horse Dam; and two congressional documents—Colorado River Storage Project (H. D. 364), and Chief Joseph Dam Project, Washington (H. D. 374).

Two engineering monographs were published by the office of the Assistant Commissioner and Chief Engineer, at Denver, during the year. One of the monographs describes hydraulic models tests and compares the performances of the models of two dam spillways with the performances of their prototype structures. The second monograph presents an analysis of the effects of the huge mass of water impounded in Lake Mead behind Hoover Dam upon the local deformation of the earth's crust in the Lake Mead area. Four technical memoranda were published covering the subjects of stress analysis of a multiple-arch dam, impervious soils used in rolled earth dams, a 15-year report on the structural behavior of Grand Coulee Dam, and calculation of stress from strain in concrete.

Also published at Denver were the technical records on the design and construction of O'Sullivan Dam, Long Lake Dam and main canal, and equalizing reservoir dams and feeder canal—all important structures of the Columbia Basin project in Washington—and Platoro Dam, a feature of the San Luis Valley project in Colorado. Other material published included 141 laboratory reports, 252 construction and supply specifications, and 43 detailed designers' instructions for use in the operation of irrigation and power facilities.

The first edition of the Earth Manual, containing information on the use of earth materials for construction purposes, and the 11th edition of the Hydraulic and Excavation Tables, comprising computational data for use in design and construction of hydraulic structures, were virtually completed at year's end and were planned to be submitted for printing by the Government Printing Office in fiscal year 1956.

The Publications Branch at Washington, D. C., received 716 requests for publications and distributed 9,365 copies. Of this number, 128 were congressional requests for 952 publications.

Seven hundred and ninety-six films were distributed to television stations, agricultural and engineering institutions, water users' associations, organizations of farmers, conventions, foreign countries, foreign visitors, and others. The increase of 100 requests over last year was due to the increasing demand for the film, *Columbia Frontier*.

The Branch received 135 requests for 1,362 photographs for illustration or exhibition purposes in Bureau publications, encyclopedias, various agricultural and engineering magazines, newspapers, exhibits, lectures, etc. Requests were also received from congressional offices, visitors from other Government agencies for exhibition and publication purposes in the United States and foreign countries. Eight requests were received for 133 kodachrome slides to be used in lectures.

In response to the 4,000 requests for Bureau informational material received at Denver, more than 11,000 technical publications and informational pamphlets were distributed. Sales of Bureau publications totaled \$21,575, sales approximately two-thirds of this total being made to citizens of foreign governments. Sales of publications sold for the Superintendent of Documents totaled \$3,224.

LEGAL

Under the reorganization of the Solicitor's Office in the Department of the Interior, responsibility for handling legal phases of matters arising in connection with the programs and activities of the Bureau of Reclamation has been vested in the Office of Associate Solicitor, Water and Power. During the past year, the Associate Solicitor supervised the work of the Assistant Solicitor, Reclamation, who is initially responsible for all legal matters connected with the work of the Bureau. As heretofore, attorneys assigned to these tasks participated in the solution of the sundry legal problems of the Bureau of Reclamation in such varied fields as construction, supply contracts and contract administration, negotiation of repayment contracts, problems connected with the generation and disposition or purchase of electric power and energy, condemnation proceedings, tort matters, and advice on daily operations problems.

Legislation

The fiscal year 1955 included the final portion of the second session of the 83d Congress and the initial portion of the first session of the 84th Congress. The following statutes of major importance to the Bureau of Reclamation were enacted during the fiscal year:

Public Law 551 (68 Stat. 580) providing authority for the transfer of title to movable property to water users' organizations on Federal reclamation projects.

Public Law 750 (68 Stat. 1044) further extends authorities under sections 7 and 17 of the Reclamation Project Act of 1939 to January 1, 1957.

Public Law 130 (69 Stat. 244) authorizes loans to irrigation districts or other public agencies to construct distribution systems authorized to be constructed under the Federal reclamation laws.

Public Law 578 (68 Stat. 690) granting consent of Congress to a compact entered into by the States of Louisiana and Texas and relating to the waters of the Sabine River.

Public Law 97 (69 Stat. 184) granting consent of Congress to States of Arkansas and Oklahoma to negotiate and enter into a compact relating to the waters of the Arkansas River.

Litigation

Major litigation involving water and power problems during the year were:

1. *Rank v. Krug*, et al., the complaint in this case originally was filed in 1947 in the Superior Court of the State of California in and for the county of Fresno. Upon the motion of the Department of Justice the case was removed to the United States District Court for the Southern District of California, Northern Division. At about the same time, four other actions were filed for similar relief against the same parties. These actions also were removed to the same United States district court.

The court has jurisdiction of four of the named defendant officials of region 2 of the Bureau of Reclamation, including the regional director. A number of irrigation districts in the Friant-Kern Canal and Madera Canal areas also are defendants. The State of California, through its attorney general, and the city of Fresno are intervenors in the case. The plaintiffs also filed separate suits in the same United States district court for compensation under the Tucker Act.

All of these suits directly involve the water rights of a class alleged from time to time to comprise 1,400 landowners claimed to be affected by the operation of Friant Dam and Reservoir.

The plaintiffs claim, as a class, that they own riparian, appropriative, prescriptive, and ground-water rights to the full flow of the San Joaquin River, unrestricted by operations by the United States. For their use they seek an absolute injunction against the operation of Friant Dam and its diversion works. In the alternative, they request a regulated flow of the river to simulate the optimum conditions

that a flow of 2,500 cubic feet per second would provide for downstream water users at any time that such water is available in Friant Reservoir. As a second alternative, they request a physical solution to simulate a flow of 2,000 cubic feet per second, plus the installation and operation of some 14 check dams in the river, which would cost several million dollars. As a third alternative, the plaintiffs request relief by way of "reverse condemnation," as that term is used by the California courts.

As against these pleas of the plaintiffs, the defendants have interposed a general denial and have submitted plans for physical solutions of the problems.

In early 1950, motions for a preliminary injunction and to dismiss (except as to the Tucker Act cases) were consolidated and heard at Los Angeles. Both motions were denied, except that in one of the incidental cases the motion to dismiss was granted. The decision on these motions is reported in *Rank v. Krug*, 90 F. Supp. 773 (1950).

During July and August 1951, further hearings were held at Fresno on a renewed motion for a preliminary injunction. The result was a stipulated order covering phases of the operation of the river for a limited period of time.

In December 1951 and January 1952, pretrial hearings were held, an order was made thereon, and the case was set for trial to begin at Fresno on January 29, 1952. The trial was concluded during July of 1953.

In the spring of 1953 an order was entered requiring certain releases from Friant Dam. The United States went into the circuit court, and in an opinion dated August 4 this order was dissolved. The basis of the decision was that the order affected property of the United States and that the United States was not a party. Subsequently during August the plaintiffs moved to join the United States as a party and to reopen the trial. The United States was joined by order of the court on September 18, 1953. The United States then applied to the circuit court for a motion to restrain further proceedings in the case and to dismiss the United States as a party. On February 1, 1954, the court denied the motion. The basis of the denial was to the effect that after such a long trial it would be premature to consider the issues raised in a special proceeding and that the issues could be considered on appeal. The case is now before the Supreme Court of the United States pending decision.

2. In the Matter of the California Oregon Power Company, on April 16, 1951, Copco filed an application with the Federal Power Commission for a license for its proposed Big Bend No. 2 project, identified by the Federal Power Commission as project No. 2082. The Secretary of the Interior, following his recommendation to the

Commission that the application be denied for the reasons that it might impair the rights to water of the United States, would be detrimental to irrigation and development of land in the Klamath project, and would foreclose comprehensive water resource development in the Klamath River Basin, was formally admitted as a party to the proceeding and to a companion proceeding. (Docket No. E-6390, discussed separately.)

The Presiding Examiner's Recommended Decision on project No. 2082 (October 2, 1953) recommended that Copco be granted a license subject to the condition that within 1 year the company should obtain an extension or renewal, for the 50-year term of the license, of the 1917 contract with the United States covering the operation of Link River Dam. The company filed exceptions to the recommended decision on the ground that the trial examiner erred in determining that the Commission had jurisdiction on the basis of the company's use of surplus water from a Government dam. The Department did not file exceptions but appeared at the hearing before the Commission on December 1, 1953. The purpose of the appearance was to counter statements made in Copco's exceptions negating the water rights of the United States. On January 28, 1954, the Commission issued its opinion No. 266 affirming the recommended decision of the trial examiner. Copco's petition for a rehearing was denied. Copco appealed this decision to the United States Court of Appeals for the District of Columbia (No. 12235). While retaining jurisdiction, the court remanded the case to the Commission to obtain answers to certain questions. Copco filed a brief before the Commission with respect to these questions. At the end of the fiscal year, the Commission had not yet submitted its explanatory opinion to the court.

3. *In the Matter of the California Oregon Power Company*, this proceeding is a companion to project No. 2082 and was commenced by an order to show cause, issued November 28, 1951, to Copco by the Federal Power Commission. The order required Copco to show cause why it should not file applications for licenses for five of its existing hydroelectric plants on the Klamath River in Oregon and California.

The main issues in this proceeding are whether the Commission has licensing jurisdiction over the five plants, and, assuming that the Commission does have jurisdiction, on what particular ground it should be based. Staff counsel for the Commission contended that several bases of jurisdiction exist, among others, that the plants utilize surplus water from a Government dam.

The dam in question is the Link River Dam, constructed by Copco in 1917 pursuant to a 50-year contract between Copco and the Bureau of Reclamation. In essence, the contract provided for the construction of the Link River Dam by Copco and the transfer thereof to

the United States, the operation of Link River Dam by Copco to meet certain irrigation requirements of the Klamath project, and the reduction, by Copco, of certain power rates for pumping in the Klamath project. Thus, although the primary purpose of the dam is to provide water for irrigation of the Klamath project, Copco may also make limited releases of water for the generation of power. Copco has two plants at Klamath Falls, one at Keno, Oreg., and two near Copco, Calif., all of which are operated through water releases from Link River Dam.

The Presiding Examiner's Recommended Decision on Docket No. E-6390 (October 2, 1953) holds that the Commission has jurisdiction under the Federal Power Act on grounds, among others, that the plants utilize surplus water from Link River Dam. Although originally opposing this particular ground of jurisdiction, the Secretary of the Interior did not file exceptions to the recommended decision because, in effect, the interests of the United States are protected by the condition to the license imposed in project No. 2082. Copco, however, filed exceptions and, for reasons indicated in the discussion of project No. 2082, the Department appeared at the hearing before the Commission on December 1, 1953. The Commission's decision No. 266 (January 28, 1954) affirmed the "surplus water" as a jurisdictional basis for license. Copco appealed this decision to the United States Court of Appeals for the District of Columbia (No. 12236). While retaining jurisdiction, the court remanded the case to the Commission to obtain answers to certain questions. Copco filed a brief before the Commission with respect to these questions. At the end of the fiscal year, the Commission had not yet submitted its explanatory opinion to the court.

4. *State of Arizona v. State of California, et al.*, is an action in the Supreme Court of the United States by which Arizona seeks a determination of its rights in and to the use of the waters of the Colorado River, as against such rights claimed by the defendants under the Colorado River compact, the Boulder Canyon Project Act, and the California Limitation Act. Leave to intervene was granted on December 31, 1952, on the motion of the United States, and, pursuant thereto, petition of intervention on behalf of the United States was filed December 8, 1953. Motion on behalf of the State of Nevada for leave to intervene and petition of intervention on behalf of the State of Nevada were also filed with the court during December 1953. By order of the court on June 1, 1954, the State of Nevada was granted leave to intervene. The special master appointed by the court held hearings during April 1955. His report on the motion of the California defendants to join as parties the States of New Mexico, Utah, Colorado, and Wyoming was submitted to the court shortly after the end of the fiscal year.

5. *Hudspeth County and Reclamation District No. 1 v. Robbins, et al.* (an employee of the Bureau of Reclamation), a suit for declaratory judgment to establish the water rights of the plaintiff and to enjoin officers of the United States from impounding and diverting certain waters allegedly belonging to the district was originally filed in the District Court for Hudspeth County, Tex., and later removed to the United States District Court, Western District of Texas, El Paso Division. On the plaintiff's motion for partial summary judgment and on the defendant's motion for summary judgment, the court ordered that the relief sought by the plaintiff be denied. The case was appealed, and, following oral hearings, remanded with directions to dismiss the complaint for want of jurisdiction (213 F. (2d) 425 (1954)). On October 14, 1954, the Supreme Court of the United States denied the plaintiff's petition for a writ of certiorari (348 U. S. 833).

6. *El Paso County Water Improvement District No. 1 and the United States, et al. v. The City of El Paso*, was filed in the United States District Court, Western District of Texas, El Paso Division, in January 1953, to resolve a number of controversies existing between the litigants, including the extent of certain alleged water rights of the city, the validity of obligations previously entered into, the validity of conveyances of the Franklin Canal right-of-way, and obligations for maintenance of bridges. Several hearings have been held for discovery purposes. At the end of the fiscal year the case had been tried and a decision is pending.

7. Two cases, both entitled *Provo Bench Canal & Irrigation Company, et al. v. Linke, State Engineer, and the United States*, to review decisions of the State engineer approving applications by the United States to change the point of diversion and place of use of water acquired by the United States for the Provo River project, were tried on their merits in the District Court of the Fourth Judicial District in and for Utah County, State of Utah. The trial court decided the case adversely to the Government's position. At the close of the fiscal year the question of initiating an appeal was under consideration.

8. *Desert Beach Corporation v. United States Imperial Irrigation District, Coachella Valley County Water District, et al.*, was filed in the United States District Court for the Southern District of California, Central Division, in October 1953. This is an action seeking to recover \$450,000 in damages to plaintiff's properties alleged to have been caused by the negligent and wrongful acts or omissions of the defendants. On April 12, 1954, an order was entered dismissing the United States from the above action on the ground that plaintiff's complaint failed to allege any specific acts of negligence by Government employees acting in the course of their employment. Motions

by the Imperial and Coachella districts for dismissal on the ground of lack of diversity of citizenship were taken under advisement by the court. On June 2, 1954, plaintiff filed its first amended complaint and the United States thereafter again moved to dismiss the action on the ground that the amended complaint fails to allege any specific act of negligence on the part of Government employees and also based on the "discretionary act" provision (28 U. S. C. A. 2680) of the Federal Tort Claims Act. On January 7, 1955, defendant districts were dismissed from the action on the ground of lack of diversity of citizenship, and defendants Does 26 to 100, stated by the complaint to be employees of the United States, were dismissed by the court on its own motion. The motion of the United States for dismissal was denied. On February 2, 1955, a stipulation was entered into that the United States need not file a responsive pleading until 10 days after demand is made therefor by the plaintiff.

9. *The Atchison, Topeka and Santa Fe Railway Company v. United States*, petition was filed in the court of claims in February 1954 for damages allegedly arising in connection with the construction of Elephant Butte Dam from heavy siltation and sedimentation in the Sap Marcial area. Answer was filed on June 9, 1954.

10. *Citizens Utilities Company v. E. G. Nielsen, et al.* (an employee of the Bureau of Reclamation) United States Court of Appeals for the Ninth Circuit. This is an action to enjoin and restrain the United States from doing or failing to do any act or thing which would cause or result in an interference with or disruption of the delivery of Hoover Dam electrical energy to plaintiff company under its contract for the purchase of unused Metropolitan Water District energy which terminated December 31, 1954. On December 24, 1954, a temporary restraining order and order to show cause was issued. On January 21, 1955, the complaint was dismissed on the grounds that the suit is in reality a suit against the United States, which has not consented to be sued, and that the Secretary of the Interior is an indispensable party to the action. At the same time, the temporary restraining order was quashed. On January 24, 1955, plaintiff filed its appeal to the United States Court of Appeals for the Ninth Circuit and moved for restoration and continuance of the restraining order pending appeal, which motion was denied. On June 20, 1955, the Department advised the Senate Committee on Interior and Insular Affairs that if suit is instituted in the Court of Claims and, after determination of the rights of all interested parties, final judgment is rendered favorable to the company's claims, the United States will enter into arrangements for the resumption of service.

11. Contested validation proceedings involving the Ivanhoe and Madera irrigation districts and the Santa Barbara County Water

Agency are on appeal before the Supreme Court of California, where decision is pending.

Contract Litigation

During the fiscal year the Bureau of Reclamation was involved in 15 cases in the Federal courts concerning claims totaling approximately \$2,700,000 arising in connection with construction and supply contracts. Bureau of Reclamation and Solicitor's personnel participated with the Department of Justice in the defense of these cases and in negotiations of compromise settlements of several of the cases. At the end of the fiscal year, 9 cases either had been decided by the courts or settled through compromise. These 9 cases involved claims totaling approximately \$2,200,000. The compromise settlements and judgment totaled about \$100,000.

BONNEVILLE POWER ADMINISTRATION

William A. Pearl, *Administrator*



FINANCIAL RESULTS OF OPERATIONS

AS A RESULT of below normal temperatures experienced throughout the Columbia River Basin area during the early months of 1955, the Administration found it necessary to curtail deliveries of interruptible power to industry. This situation lasted from the latter part of March until early May. However, the addition of 10 generating units—4 at McNary, 3 at Lookout Point, 2 at Albeni Falls and 1 at Dexter—added 443,400 kilowatts of installed capacity during the year.

These factors resulted in an increase in sales, and gross revenues kept pace with an increase of \$6,748,789 or 14.9 percent, for a total of \$52,066,482, largest since inception of the program. All costs of operation, including maintenance charges, interest and depreciation expense, and miscellaneous charges, were exceeded by a comfortable margin and resulted in net revenues of \$8,591,305. The addition of higher cost projects plus some curtailment of sales due to below normal stream flows during the period of March to May 1955, caused a decrease in net revenues of \$46,405 from the net revenues of \$8,637,710 reported for fiscal year 1954.

Table I presents a combined statement of revenues and expenses for the system. The data are prepared from commercial cost accounts kept in accordance with the Federal Power Commission system of accounts prescribed for electric utilities.

TABLE I.—*Columbia River power system—condensed summary of revenues and expenses—operating projects only*

	Fiscal year 1954	Fiscal year 1955	Total to June 30, 1955
Operating revenues.....	\$45,317,693	\$52,066,482	\$401,813,269
Expenses of operation, maintenance, etc.....	12,804,967	13,101,399	108,462,928
Provision for depreciation.....	11,638,135	14,516,958	80,462,504
Interest expense.....	12,248,197	15,937,409	101,080,450
Miscellaneous deductions, net.....	(11,316)	(80,589)	1,727,653
Total deductions.....	36,679,983	43,475,177	291,733,535
Accumulated net revenues from operations.....	8,637,710	8,591,305	110,079,734

Summary of Revenue

Table II summarizes by customer categories the source of revenues by fiscal years to and including 1955. The aluminum industry accounted for 32.48 percent of the revenue dollar for fiscal year 1955, while industries other than aluminum accounted for 13.10 percent, making a total of 45.58 percent of the gross revenues for the year provided by industrial customers.

TABLE II.—*Revenue by class of customers through fiscal year 1955*

Class of customer	1950 and prior	1951	1952	1953	1954	1955	Total to June 30, 1955	1955 percentage (dollar revenue)
Industry:								
Aluminum.....	\$87,549,564	13, 523, 276	13, 376, 207	13, 545, 562	15, 944, 356	16, 909, 588	160,848,553	32. 48
Other ¹	21, 115, 345	3, 774, 798	4, 650, 425	4, 715, 747	5, 417, 177	6, 821, 850	46, 495, 342	13. 10
Publicly owned utilities.....	29, 021, 848	9, 947, 909	12, 973, 025	13, 882, 890	14, 882, 997	17, 601, 135	98, 309, 804	33. 81
Privately owned utilities.....	46, 218, 881	8, 525, 609	8, 526, 775	6, 239, 276	7, 882, 879	9, 926, 150	87, 319, 570	19. 06
Other operating revenue.....	4, 979, 073	417, 436	653, 714	791, 734	1, 190, 284	807, 759	8, 840, 000	1. 55
Total operating revenue..	188,884,711	36, 189, 028	40, 180, 146	39, 175, 209	45, 317, 693	52, 066, 482	401,813,269	100. 00

¹ Includes sales to Federal agencies.

Sales to publicly owned utilities were 33.81 percent of the total and privately owned utilities 19.06. The balance of 1.55 percent made up other operating revenue.

Increased sales occurred in all categories. Sales to aluminum industries increased \$965,232, other industries \$1,404,673, publicly owned utilities \$2,718,138, and privately owned utilities \$2,043,271.

Repayment of Federal Investment

The gross Federal investment in the power portion of all the generating projects in operation and in related transmission facilities comprises the total of all funds appropriated and requisitioned for construction and operations, together with indirect items such as WPA expenditures and amounts transferred from other Federal agencies, plus the interest charge at 2½ percent on the unrepaid balance. As of June 30, 1955, this investment amounted to \$1,368,795,219, as shown in table IV. This includes accumulated interest in the amount of \$163,773,645. A summary of the interest accumulation is shown in table III.

TABLE III.—*Columbia River power system—Summary of interest on Federal investment as of June 30, 1955*

Interest during construction, to be returned during repayment period as part of the Federal investment:	
Transmission system	\$5, 437, 289
Bonneville Dam project	2, 332, 734
Columbia Basin project	9, 693, 591
Hungry Horse project	4, 708, 542
McNary Dam project	17, 985, 302
Albeni Falls project	980, 277
Detroit and Big Cliff	3, 035, 468
Lookout Point and Dexter	3, 480, 401
Subtotal	\$47, 653, 604
Interest on costs at projects allocated to future downstream river regulation, to be returned from generation at benefitted downstream projects:	
Columbia Basin project	\$13, 972, 760
Hungry Horse project	769, 754
Albeni Falls project	297, 077
Subtotal	\$15, 039, 591
Interest charged to operations:	
Transmission system	\$36, 814, 158
Bonneville Dam project	19, 029, 826
Columbia Basin project	35, 156, 722
Hungry Horse project	4, 200, 039
McNary Dam project	3, 486, 648
Albeni Falls project	429, 530
Detroit and Big Cliff	1, 638, 083
Lookout Point and Dexter	325, 444
Subtotal	\$101, 080, 450
Gross interest accumulation	\$163, 773, 645

With the exception of the amounts transferred to the continuing fund, all receipts from power sales and miscellaneous sources allocated to power are deposited in the Treasury to repay the Federal investment.

As of June 30, 1955 repayments total \$390,040,963, leaving an unpaid balance of \$978,754,256. Of the total repaid, \$197,852,576 represents payment of all current expenses since inception of the program; the remaining amount of \$192,188,387 is repayment on the capital investment of \$1,170,942,643 as shown in table IV.

TABLE IV.—Columbia River power system—summary of Federal investment in operating power projects and repayment as of June 30, 1955

	Gross invest- ment	Repayments	Net invest- ment
Investment in current expenses:			
Operation, maintenance, etc.....	\$96, 772, 126	\$96, 772, 126	-----
Interest ¹	101, 080, 450	101, 080, 450	-----
Total current expenses.....	197, 852, 576	197, 852, 576	-----
Investment in capital assets:			
Electric plant inventories, etc. ²	1, 123, 063, 162	-----	-----
Unexpended appropriations.....	47, 879, 481	-----	-----
Total capital investment.....	1, 170, 942, 643	192, 188, 387	\$978, 754, 256
Total Federal investment.....	1, 368, 795, 219	390, 040, 963	978, 754, 256

¹ The Columbia River power system does not receive appropriations for payment of interest, but imputes and includes in its accounts provisions for interest expense and returns receipts to the Treasury in repayment of such expenses.

² Includes interest during construction of \$47,653,604, which will be repaid to the Treasury as part of capital cost of electric plant and \$15,039,591 of interest charged to future downstream regulation recoverable from operations of future downstream hydroelectric plants.

Inasmuch as no increase in the basic \$17.50 kilowatt-year rate will be made prior to December 1956, additional generation scheduled for future years, while increasing gross revenues, will reflect lower net revenue due to higher construction costs together with added interest and depreciation expenses for the newer projects.

If necessary, a rate adjustment may be made after approval of the Federal Power Commission effective on December 20 of the years 1956 to 1959.

A summary of plant accounts as of June 30, 1955, is shown in table V.

TABLE V.—Columbia River power system—summary of plant accounts in operating projects as of June 30, 1955

Project	Total	Allocation	
		Nonpower	Power
Bonneville Power Administration.....	\$368, 913, 677	-----	\$368, 913, 677
Bonneville Dam project.....	86, 895, 909	\$27, 302, 499	59, 593, 410
Columbia Basin project.....	487, 468, 408	282, 287, 375	205, 181, 033
Hungry Horse project.....	107, 368, 442	20, 851, 472	86, 516, 970
Albeni Falls project.....	30, 396, 644	291, 628	30, 105, 016
McNary Dam project.....	289, 865, 955	25, 658, 691	264, 207, 264
Detroit and Big Cliff projects.....	65, 643, 472	24, 112, 941	41, 530, 531
Lookout Point-Dexter project.....	92, 259, 614	50, 903, 916	41, 355, 698
Total plant.....	1, 528, 812, 121	431, 408, 522	1, 097, 403, 599
Less: Combined reserve for depreciation.....	-----	-----	76, 057, 579
Total less reserve.....	-----	-----	1, 021, 346, 020

Based on individual projects the return of power capital investment has been as follows:

Project	Power capital ¹ investment	Repaid as of June 30, 1955	Percent repaid	Net power ¹ investment
Bonneville Power Administration.....	\$383,200,518	\$94,849,512	24.75	\$288,351,006
Bonneville Dam project.....	59,812,351	22,991,224	38.44	36,821,127
Columbia Basin project.....	221,573,779	58,802,897	26.54	162,770,882
Hungry Horse project.....	87,883,133	4,359,403	4.96	83,523,730
Albeni Falls project.....	29,935,243	549,617	1.84	29,385,626
McNary Dam project.....	257,870,656	8,797,362	3.41	249,073,294
Detroit-Big Cliff project.....	41,644,652	1,431,187	3.44	40,213,465
Lookout Point-Dexter project.....	41,142,830	407,185	.99	40,735,645
Total.....	1,123,063,162	192,188,387	17.11	930,874,775

¹ Exclusive of unexpended funds in U. S. Treasury.

Foregoing data on repayment of the investment are based on cost accounts maintained in accordance with the Federal Power Commission uniform system of accounts. On a statutory repayment basis, the repayment percentages are the same as in the above table for the Bonneville Power Administration and Bonneville Dam, but different for the Columbia Basin project, since in the case of the latter (1) power revenues must pay operation and maintenance costs of Grand Coulee Dam and power plant allocated to irrigation, (2) interest expense is computed at 3 percent rather than 2½ percent, and (3) other differences such as the exclusion of interest during construction in the payout accounts of the Columbia Basin project.

SUMMARY OF OPERATIONS

Energy Production

Energy generated at nine Federal plants for the Administration totaled 23.3 billion kilowatt-hours during fiscal year 1955. This was an increase of 15 percent over fiscal year 1954. The three new plants connected to the system during this last fiscal year were Albeni Falls, Dexter, and Lookout Point. Four new generating units at McNary were brought into production during the year.

New System Peak

A new system peak was reached for the hour 5-6 p. m. on December 27, 1954, before the two generators at Albeni Falls, the Dexter unit, and the sixth, seventh, and eighth generators at McNary were in operation. Maximum coincident demand on Bonneville, Detroit-Big Cliff, Grand Coulee, Hungry Horse, Lookout Point, and McNary plants was 3,651,000 kilowatts, an increase of 11 percent over the previous fiscal year's maximum demand of 3,301,000 kilowatts occurring during January 1954.



Since the fall of 1946 maximum system demands have continuously exceeded the nameplate rating of installed generators. Energy produced at Federal plants for the Administration is shown by years in table VI with peak demand and energy data in the accompanying chart. Prepared on a quarterly basis, the chart on page — shows the general trends of the Bonneville Power Administration system-load growth and development.

TABLE VI.—*Generation at Federal plants for Bonneville Power Administration, fiscal years 1939–55*

[Generation in millions of kilowatt-hours]

Fiscal years ending June 30—	Albeni Falls	Bonne- ville	Detroit- Big Cliff	Grand Coulee	Hungry Horse	Lookout Point- Dexter	McNary	Total for Bonne- ville Power Adminis- tration
1939-----	-----	35	-----	-----	-----	-----	-----	35
1940-----	-----	208	-----	-----	-----	-----	-----	208
1941-----	-----	894	-----	8	-----	-----	-----	902
1942-----	-----	1,807	-----	742	-----	-----	-----	2,549
1943-----	-----	2,801	-----	2,817	-----	-----	-----	5,618
1944-----	-----	3,489	-----	5,751	-----	-----	-----	9,240
1945-----	-----	3,391	-----	5,661	-----	-----	-----	9,052
1946-----	-----	2,675	-----	3,561	-----	-----	-----	6,236
1947-----	-----	3,696	-----	5,058	-----	-----	-----	8,754
1948-----	-----	3,992	-----	¹ 6,894	-----	-----	-----	10,886
1949-----	-----	3,869	-----	¹ 9,057	-----	-----	-----	12,926
1950-----	-----	3,690	-----	¹ 10,451	-----	-----	-----	14,141
1951-----	-----	3,793	-----	¹ 12,679	-----	-----	-----	16,472
1952-----	-----	4,463	-----	¹ 14,092	-----	-----	-----	18,555
1953-----	-----	4,227	2	¹ 13,277	127	-----	-----	17,633
1954-----	-----	4,406	² 425	¹ 13,886	682	-----	797	20,196
1955-----	21	4,336	² 467	¹ 13,684	956	² 193	3,596	23,253
Total-----	21	51,772	894	117,618	1,765	193	4,393	176,656

¹ Includes energy transferred for Bureau of Reclamation.

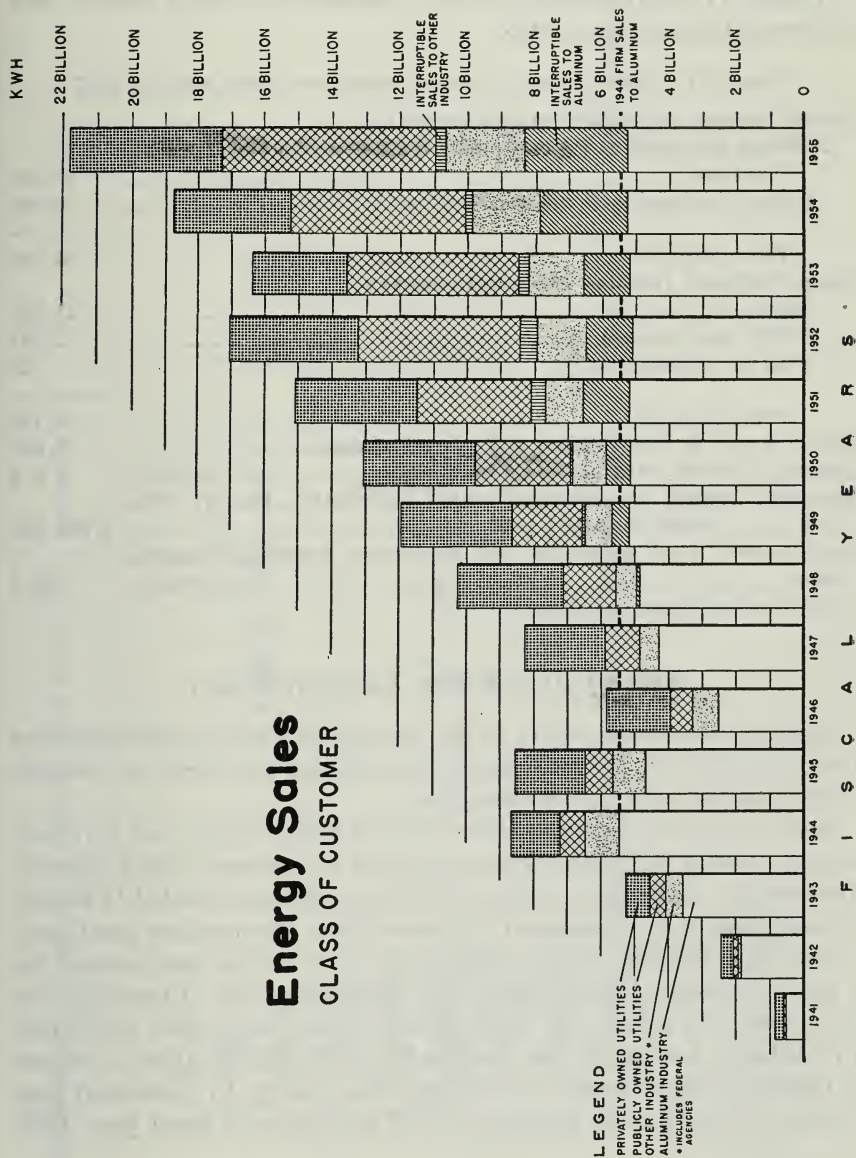
² Excludes energy for condenser power at Detroit and Lookout Point.

Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result, electric energy receipts and deliveries on Bonneville's transmission system cover many complex transactions in addition to receipts from Federal power plants and deliveries by sales.

The integrated transmission grid makes possible the fullest utilization of power facilities in the area through diversity in peaking and water capabilities and diversity of system-load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

Transactions also involve storage by the Administration in non-Federal reservoirs as well as storage by non-Federal utilities in the Grand Coulee reservoir. Disposition of energy includes deliveries from storage in Grand Coulee or to storage in other reservoirs, energy



transfers for the Bureau of Reclamation from Grand Coulee, energy used by the Administration and energy losses in transmission and transformation.

Table VII, electric energy account, summarizes energy receipts and deliveries for fiscal year 1955.

Table VII.—Electric energy account, fiscal year ended June 30, 1955

Energy received (millions of kilowatt-hours) :

Energy generated at Federal plants for Bonneville Power Administration ¹ -----	23, 253
Power purchased and interchanged in-----	2, 463

Total received-----	25, 716
---------------------	---------

Energy delivered (millions of kilowatt-hours) :

Sales-----	21, 823
Power interchanged out-----	2, 261
Used by Administration-----	26

Total delivered-----	24, 110
----------------------	---------

Energy losses in transmission and transformation-----	1, 606
---	--------

Losses as percent of total energy received-----percent--	6. 2
--	------

Maximum demand on generating plants (kilowatts), Dec. 27, 1954, 5-6 p. m., Pacific standard time-----	3, 651, 000
--	-------------

Load factor, total generated for Bonneville Power Administration -----percent--	72. 7
---	-------

¹ For detail by plants, see table VI.

Sale of 21.8 Billion Kilowatt-Hours

Energy sales to customers of the Bonneville Power Administration totaled 21.8 billion kilowatt-hours during fiscal year 1955, an increase of 16.2 percent over the previous year.

Sales of electric energy to other utilities, both publicly and privately owned, totaled 10.8 billion kilowatt-hours, an increase of 25.3 percent. Deliveries to industrial plants and Federal agencies totaled 11 billion kilowatt-hours, an increase of 8.5 percent over the previous fiscal year.

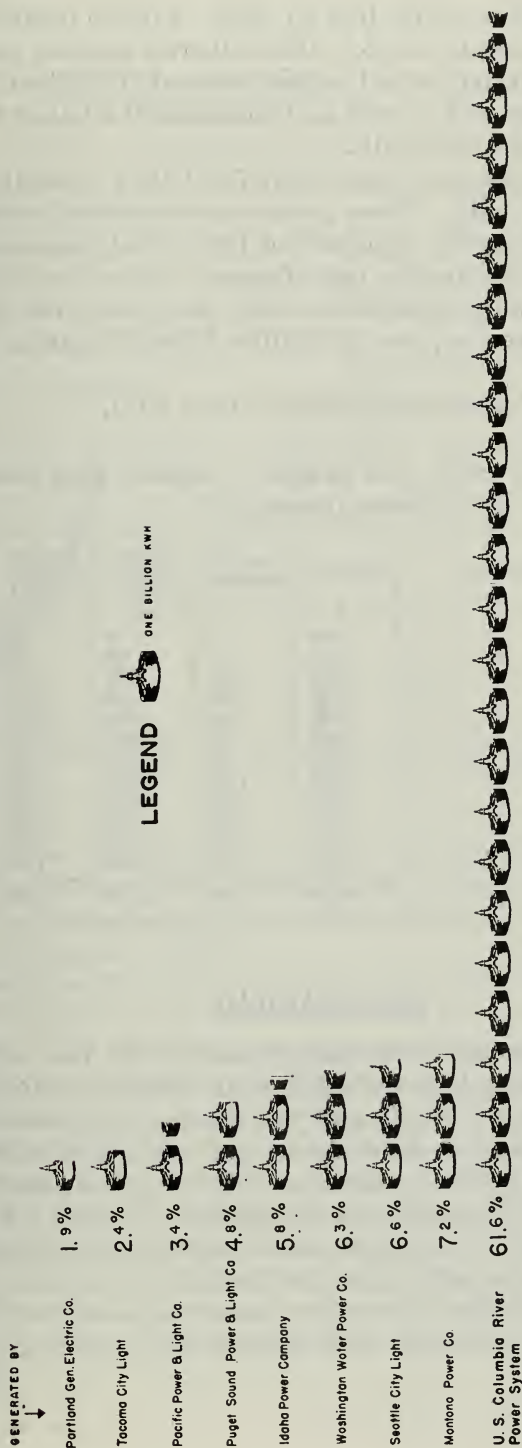
Due to favorable water conditions for most of the year, except for a short period in March, April, and May, when lack of precipitation combined with subnormal temperatures caused streamflow conditions to fall below median, it was possible for the Administration to deliver 3 billion kilowatt-hours of interruptible energy to industrial customers. This was an increase of 16.7 percent over fiscal year 1954.

Composite Average Rate of 2.39 Mills

The Administration has sold 164.5 billion kilowatt-hours of energy at a composite average rate of 2.39 mills per kilowatt-hour during the

Power Generated by the Principal Electric Utilities of the Pacific Northwest

YEAR ENDED JUNE 30, 1965



TOTAL 37.8 BILLION KWH

THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

SOURCE: WEEKLY OPERATING REPORTS OF N.W. POWER POOL

17 years of operation ending June 30, 1955. Sales to publicly owned utilities for this period were 35.1 billion kilowatt-hours at an average of 2.80 mills. Privately owned utilities received 37.5 billion kilowatt-hours at an average of 2.32 mills and industries 91.9 billion kilowatt-hours at an average of 2.26 mills.

Power sales to aluminum plants were 75.0 billion kilowatt-hours at an average of 2.15 mills. These plants characteristically take power at very high load factors, approaching 100 percent, which results in the exceptionally low average cost of power on the Administration's C rate schedule. Sales to industries other than aluminum, including sales to Federal agencies, were 16.9 billion kilowatt-hours at an average of 2.74 mills.

Sales by class of customer are shown in table VIII.

TABLE VIII.—*Electric energy sales by class of customer, fiscal years 1939–55*

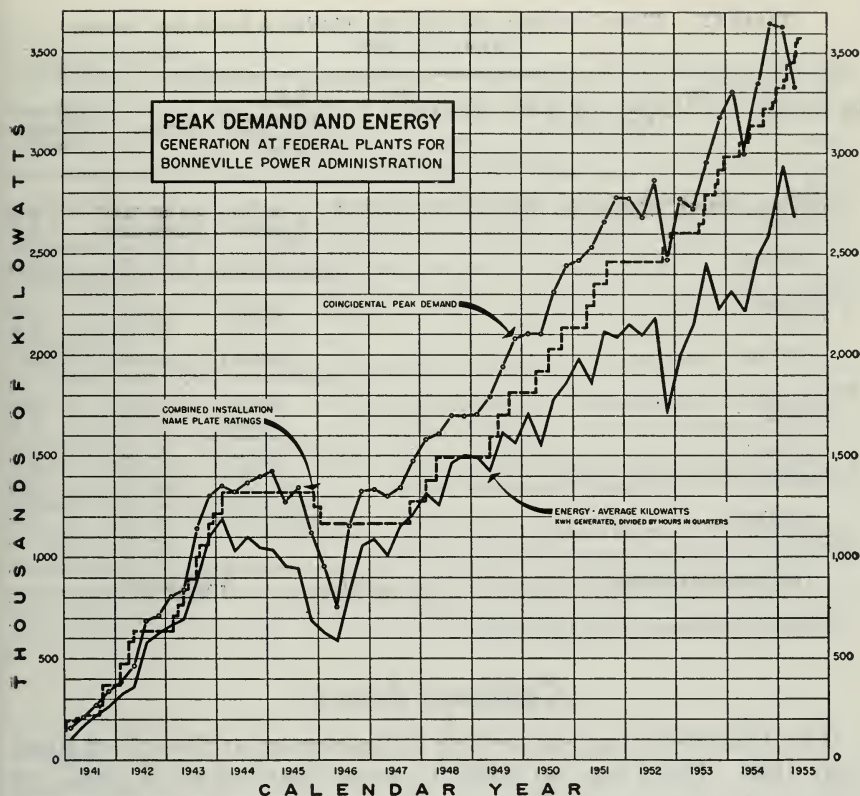
[Millions of kilowatt-hours]

Fiscal years ending June 30—	Aluminum	Other ¹ industries	Publicly owned utilities	Privately owned utilities	Total
1941 and prior.....	523	5	35	537	1,100
1942.....	1,845	79	143	358	2,425
1943.....	3,589	507	435	739	5,270
1944.....	5,454	1,022	728	1,467	8,671
1945.....	4,667	965	824	2,057	8,513
1946.....	2,492	800	636	1,903	5,831
1947.....	4,212	627	1,045	2,378	8,262
1948.....	4,902	647	1,561	3,181	10,291
1949.....	5,666	881	2,081	3,342	11,970
1950.....	5,863	1,024	2,840	3,312	13,039
1951.....	6,545	1,538	3,414	3,579	15,076
1952.....	6,472	1,943	4,803	3,794	17,012
1953.....	6,547	1,947	5,110	2,791	16,395
1954.....	7,862	2,254	5,127	3,531	18,774
1955.....	8,352	2,624	6,274	4,573	21,823
Total to July 1, 1955.....	74,991	16,863	35,056	37,542	164,452

¹ Includes Federal agencies.

Rate Schedules

More than 75 percent of the energy sales for the year were made under the C-4 wholesale rate schedule at an average of 2.14 mills per kilowatt-hour. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system and is also used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities. Other sales were made principally under the E schedule to utilities purchasing all or substantially all of their power requirements from the Administration. Sales under the F schedule were made to the utilities.



and industries requiring power at low-load factor use, and under the H schedule for dump, exchange, or experimental purposes. A summary of energy sales for the fiscal year 1955 classified by rate schedules is shown in table IX.

On December 20, 1954, the Federal Power Commission approved amended wholesale power rate schedules and new general rate schedule provisions. The amended rates, while retaining the same type, form, and level of the superseded rates, contain several revisions for purposes of clarity and facility of application. Each of the approved wholesale power rate schedules contains a rate adjustment clause stipulating that the rate is subject to possible adjustment subject to Federal Power Commission approval on December 20, 1956, or 1957, or 1958 if such adjustment becomes necessary. In addition to the usual review of wholesale rates by the regular staff of the Bonneville Power Administration, a special independent review of the general wholesale rate structure was begun during this fiscal year by the Ford, Bacon & Davis Co.

TABLE IX.—*Electric energy sales by rate schedules, fiscal year ending June 30, 1955*

Rate schedule	Energy (thousands of kilowatt- hours)	Revenue	Mills per kilowatt- hour
C-3, C-4:			
Industries.....	10, 530, 159	\$22, 297, 539	2. 12
Utilities.....	6, 019, 075	13, 056, 137	2. 17
Subtotal.....	16, 549, 234	35, 353, 676	2. 14
F-2, F-3, F-4:			
Industries.....	33, 737	169, 181	5. 01
Utilities.....	101, 207	440, 427	4. 35
Subtotal.....	134, 944	609, 608	4. 52
A-4:			
Industries.....	6, 147	20, 176	3. 28
Utilities.....	10, 882	34, 021	3. 13
Subtotal.....	17, 029	54, 197	3. 18
E-4: Utilities ¹	3, 794, 320	11, 787, 875	3. 11
Experimental, H-3 and exchange: Industries and utilities.....	1, 327, 543	3, 318, 856	2. 50
Total sales.....	21, 823, 070	51, 124, 212	2. 34
Reconciliation with accounting records.....		134, 511	-----
Other electric revenues.....		807, 759	-----
Total operating revenues.....		52, 066, 482	-----

¹ Including Federal agency pumping service.

Customers Served

The Administration was serving 119 customers at the end of fiscal year 1955. There were 80 publicly owned distributors of power, 18 industrial customers, 12 Federal agencies, and nine privately owned utilities. Service to two publicly owned distributors was initiated during the year: City of Port Angeles and Kennewick irrigation district. The Pend Oreille County PUD discontinued service when the District's Box Canyon plant was put into service. The Anaconda Aluminum Co. plant started receiving power from the Administration during this fiscal year. The two privately owned utilities which started receiving power from the Administration in this fiscal year are California-Pacific Utilities Co. and Idaho Power Co.

Generation Added

Additions to the United States Columbia River power system in fiscal year 1955 have a nameplate rating of 443,400 kilowatts. All units, with 135,000 kilowatts capacity, were installed at Lookout Point project on the Middle Fork of the Willamette River, including the unit at Dexter reregulating dam. Four additional units with total capacity of 280,000 kilowatts were installed at McNary project, and the first two units with 28,400 kilowatts capacity were installed at Albeni Falls project. The Corps of Engineers is construction agency for all three of these projects.

Projects Summarized

Federal projects existing, under construction, and authorized for construction by the Corps of Engineers and Bureau of Reclamation are shown in table X. With all these projects operating as a system, a nominal prime capability of 2,860,000 kilowatts is expected in fiscal year 1956 from the existing projects plus capacity to be installed during the year. With completion of the projects in construction status prime capability will be 4,000,000 kilowatts, and with completion of the authorized projects prime capability will be 6,698,000 kilowatts.

Existing usable storage capacity is 9,868,000 acre-feet. An additional 479,000 acre-feet will be provided by Cougar and Hills Creek on which construction will shortly begin, and 5,332,000 acre-feet would be provided by Libby and Green Peter projects which are authorized for construction.

All contemplated generation and storage capacity for the projects in construction status will be in service by November 1961, under the present schedule. Service dates for the other authorized projects are not scheduled as no funds are appropriated for their construction.

Non-Federal Additions

Additions to generating facilities of non-Federal utilities in the area served by the Administration for fiscal year 1955 have a nameplate rating of 45,000 kilowatts. A second unit of 25,000 kilowatts capacity was added at the city of Tacoma's steam plant No. 2; the first unit of 15,000 kilowatts capacity was installed at Box Canyon project by Pend Oreille County PUD; and a third unit of 5,000 kilowatts capacity was installed at the city of Centralia's Yelm plant. Future additions presently scheduled by non-Federal utilities in this area are shown in table XI.

Northwest Power Pool

Generation during fiscal year 1955 by the principal electric utility systems of the Pacific Northwest is shown in table XII. All of these utilities are members of the Northwest Power Pool. The Utah Power & Light Co. and the British Columbia Electric Co. are also members of the pool but are not included as their major service areas are outside the Pacific Northwest region.

The United States Columbia River power system supplied 62 percent of the total energy generated by the major utilities of the region. In addition to power requirements of industries and nonpool utilities

TABLE X.—U. S. Columbia River power system—general specifications—projects existing, under construction and authorized installations and capabilities correspond to a coordinated system operation

	Location	Stream	Plant installations		Nominal prime power, kilowatts *	Pool elevation (feet)	Usable storage (acre-feet)	Average head (feet)	Initial date in service	Principal purpose †
			Number of units	Total capacity, kilowatts ‡						
Existing projects:	Bonneville.....	Columbia.....	10	518, 400	458, 000	72	---	59	June 1938-----	P. N.
	Grand Coulee.....	do.....	18	1, 944, 000	1, 631, 000	1, 288	5, 072, 000	326	September 1941-----	P. I., F.C., N.
	Hungry Horse.....	South Fork Flathead.....	4	285, 000	187, 000	3, 560	2, 982, 000	364	October 1952-----	P. I., F.C., N.
	Detroit.....	North Santiam.....	2	100, 000	29, 000	1, 569	323, 000	299	July 1953-----	P. I., F.C., N.
	McNary.....	Columbia.....	14	980, 000	548, 000	340	---	78	November 1953-----	P. I., N.
	Big Cliff.....	North Santiam.....	1	18, 000	10, 000	1, 206	---	91	June 1954-----	P. I., F.C., N.
	Lookout Point.....	Middle Fork Willamette.....	3	120, 000	36, 000	929	336, 000	228	December 1954-----	P. I., F.C., N.
	Dexter.....	do.....	1	15, 000	12, 000	695	---	53	April 1955-----	P.
Projects in construction status:	Albeni Falls.....	Pend Oreille.....	3	42, 600	29, 000	2, 062	1, 155, 000	24	do.....	P., F.C., N.
				4, 023, 000	2, 940, 000	---	9, 868, 000	---		
						---	---	---		
						---	---	---		
						---	---	---		
						---	---	---		
						---	---	---		
						---	---	---		
Projects in construction status:	Chief Joseph.....	Columbia.....	16	1, 024, 000	815, 000	946	---	169	September 1955-----	P. I.
	Chandler.....	Yakima.....	2	12, 000	11, 000	620	---	118	November 1955-----	P. I.
	The Dalles.....	Columbia.....	16	1, 119, 000	651, 000	160	---	87	April 1957-----	P. N.
	Roza.....	Washington.....	2	12, 500	6, 000	1, 221	---	140	May 1958-----	P. I.
	Cougar.....	South Fork McKenzie.....	2	25, 000	14, 000	1, 683	188, 000	418	November 1960-----	P. I., F.C., N.
	Ice Harbor.....	Snake.....	3	270, 000	137, 000	440	---	97	January 1961-----	P. I., N.
	Hills Creek.....	Middle Fork Willamette.....	2	30, 000	14, 000	1, 543	291, 000	220	November 1961-----	P. I., F.C., N.
				2, 492, 500	1, 648, 000	---	479, 000	---		

Authorized projects:	Montana	Koofenal	6	600,000	264,000	2,459	5,010,000	267	P, F, C, N.
Libby	Washington	Snake	3	180,000	130,000	533		92	P, I, N.
Lower Monumental	do	do	3	195,000	139,000	633		99	P, I, N.
Little Goose	do	do	3	165,000	114,000	715		80	P, I, N.
Lower Granite	do	Columbia	18	954,000	735,000	550	(1)	146	P, F, C, N.
Priest Rapids ²	do	do	13	1,105,000	725,000	262		101	P, I, F, C, N.
John Day	Washington-Oregon	Middle Santiam	2	81,000	22,000	984	322,000	315	P, I, F, C, N.
Green Peter	Oregon	do	1	15,000	9,000	670		93	P.
White Bridge	do								
				3,295,000	2,138,000		5,332,000		
					³ 25,000				
				9,810,500	6,698,000		15,679,000		
Total, 24 projects									

¹ Nameplate rating.

² Average capability in a coordinated system during an 8-month storage release period (September 1936 through April 1937).

³ P—power; I—irrigation; F—flood control; N—navigation.

⁴ Authorization provides for flood control storage of 2,100,000 acre-feet.

⁵ Pumping requirements of 28,000 average kilowatts for 450,000 acres of the Columbia Basin project.

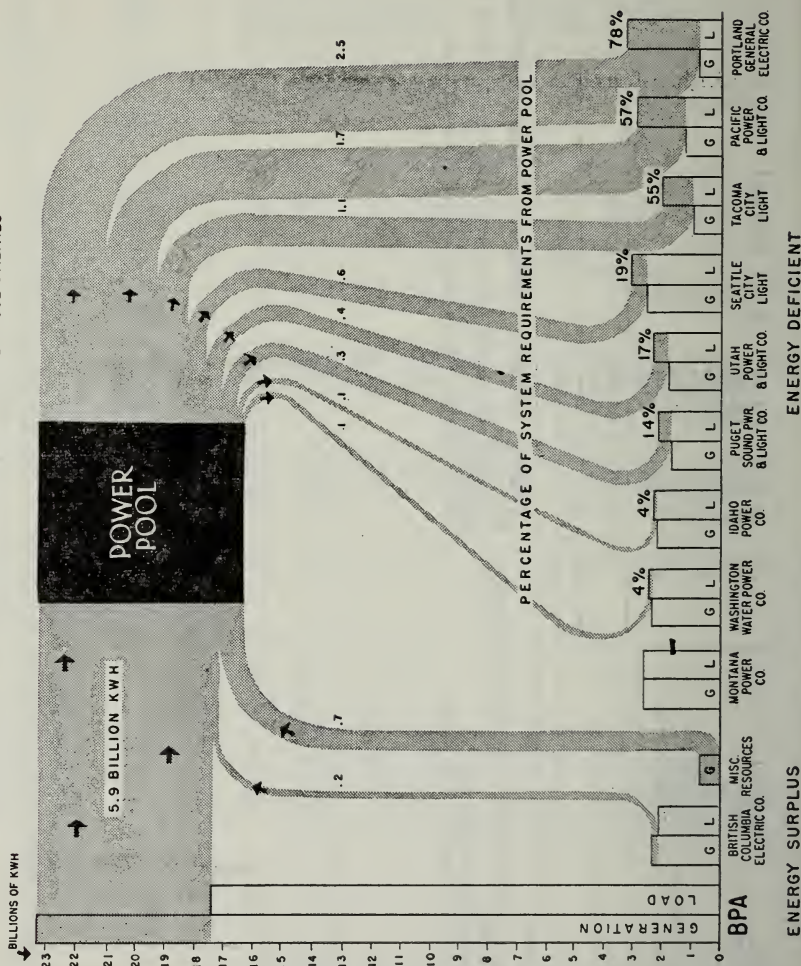
⁶ Federal authorization was removed until July 27, 1956, to permit non-Federal development.

BPA—Branch of System Operations and Power Resources, Aug. 15, 1955.

Northwest Power Pool

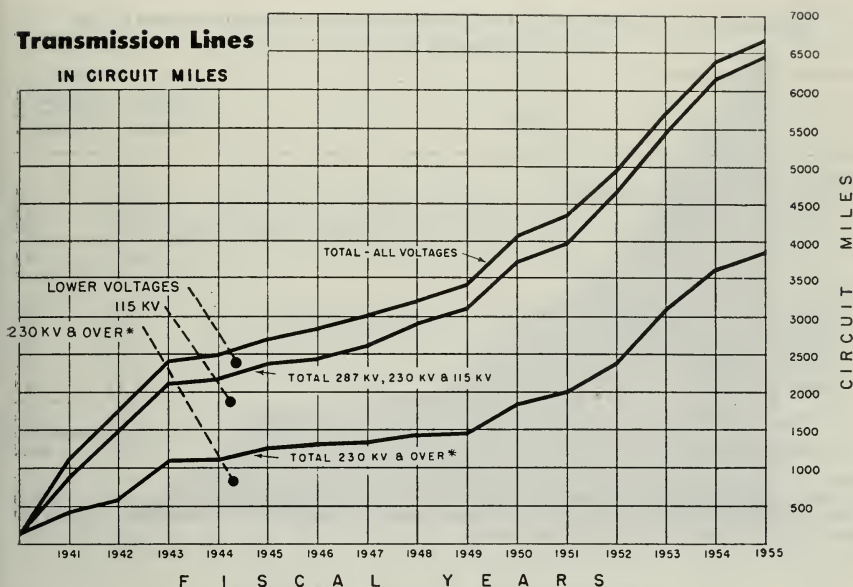
OPERATIONS YEAR ENDING JUNE 30, 1955

BPA SUPPLIED 87% OF NET ENERGY REQUIREMENTS OF POWER POOL UTILITIES



Transmission Lines

IN CIRCUIT MILES



served through the BPA transmission system, 5.9 billion kilowatt-hours of energy was provided for use by other pool utilities to meet their requirements.

TABLE XI.—Non-Federal utilities generator installation schedule, Aug. 1, 1955

Utility and plant	Stream	Unit No.	Nameplate rating, thousands of kilowatts	Date in service
Pend Oreille County PUD: Box Canyon.	Pend Oreille River.....	4	15	October 1955.
Portland General Electric Co.: Timothy Meadows Reservoir (60,000 acre-feet).	Clackamas River.....		(1)	August 1956.
City of Seattle: Ross Gorge (reconstruction of diversion dam).	Skagit River.....	4	90	December 1956.
	do.....		(2)	December 1958.
City of Tacoma: Mayfield.....	Cowlitz River.....	1	40	January 1958.
		2	40	April 1958.
		3	40	July 1958.
		4	40	October 1958.
		1	84	September 1959.
Washington Water Power Co.: Noxon Rapids.	Clark Fork.....	2	84	December 1959.
		3	84	March 1960.
		4	84	June 1960.

¹ Construction to be completed in November 1955 with initial filling in 1956 to add 10,500 kilowatts of prime power at downstream plants.

² Will increase gross head by 88 feet and peaking capability by 47,000 kilowatts.

TABLE XII.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1955*

Utilities	Kilowatt-hours (billion)	Percent of total generation
Publicly owned:		
Bonneville Power Administration.....	23.3	61.6
Seattle City Light.....	2.5	6.6
Tacoma City Light.....	.9	2.4
Total publicly owned.....	26.7	70.6
Privately owned:		
Puget Sound Power & Light Co.....	1.8	4.8
Washington Water Power Co.....	2.4	6.3
Pacific Power & Light Co.....	1.3	3.4
Portland General Electric Co.....	.7	1.9
Montana Power Co.....	2.7	7.2
Idaho Power Co.....	2.2	5.8
Total privately owned.....	11.1	29.4
Total generation ¹	37.8	100.0

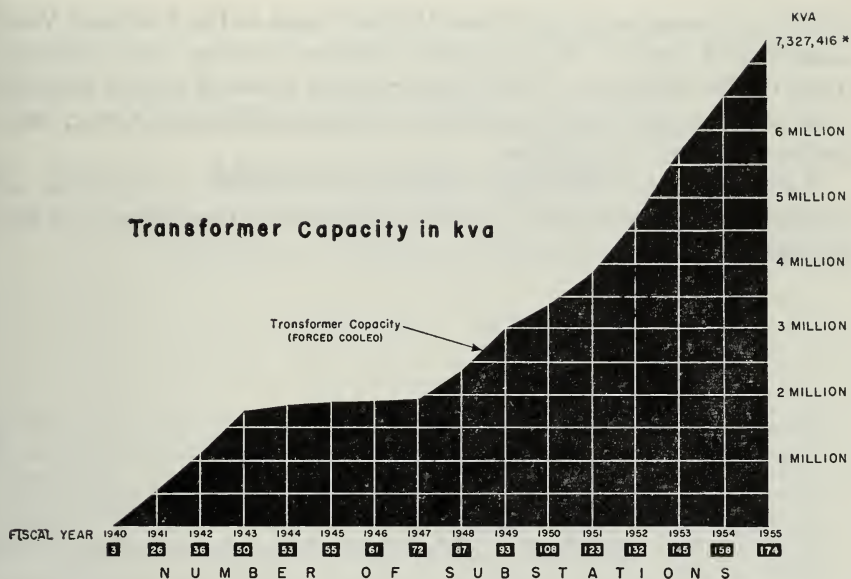
¹ The above utilities are members of the Northwest Power Pool. Utah Power & Light Co. and British Columbia Electric Co. are also members of the pool, but are not included above because their major service areas lie outside of the Pacific Northwest region.

Transmission System Additions

During the fiscal year the Bonneville Power Administration grid was increased to 6,702 circuit miles of transmission lines and to 7,327,416 kilovolt-amperes of transformer capacity. This total includes 231 circuit miles of 287,000-volt lines, 3,613 circuit miles of 230,000 volt lines, 2,627 circuit miles of 115,000 volt lines, and 231 miles of lower voltage line.

A total of 16 new substations was added to the system and the substation transformer capacity was increased by 1,174,000 kilovolt-amperes. With these additions the Administration's system includes 174 substations. Static capacitors with a capacity of 118,780 reactive kilovolt-amperes were installed, bringing the total on the system to 1,110,645 kilovolt-amperes.

To integrate the additional generation into the transmission grid and to bring it to the load centers, several major transmission lines were completed. A 90-mile section of the new McNary Dam-Vancouver, Wash., 345,000-volt line was energized at 230,000 volts in April 1955 by a temporary connection to the Midway-Big Eddy line. This line will be extended into Vancouver by the fall of 1955. In November 1954 an additional 125-mile, 230,000-volt circuit between Maupin and Albany, Oreg., was placed in operation. The operating voltage on the 231-mile Grand Coulee-Olympia line was increased from 230,000 volts to 287,000 volts in December 1954. This was accomplished by use of autotransformers on both ends of the circuit. In order to bring the generation from Lookout Point Dam into the



* INCLUDES 800,000 KVA OF AUTOTRANSFORMERS OPERATED AS PART OF TRANSMISSION LINES

Bonneville Power Administration system, a second 115,000-volt circuit was completed and placed in parallel operation with the first line between the dam and the J. P. Alvey substation.

Twelve new substations, ranging in capacity from 3,000- to 250,000-kilovolt-amperes, were energized during the fiscal year. Switching stations were completed for the Lookout Point, Albeni Falls, and Dexter Dams. Transformer capacity was increased at seven stations by the addition of transformers or forced cooling equipment to existing transformers.

New microwave facilities between Portland and the J. P. Alvey substation and expanded facilities between Portland and Snohomish substations were completed. Facilities between Portland and Spokane were placed in operation for voice communication, with work continuing on these facilities for other communication services.

The new power dispatching center in the new Interior building in Portland, Oreg., was completed; and on January 22, 1955, power dispatching was changed over from the J. D. Ross center to the Portland location.

New Construction

Major construction activity during the fiscal year was concentrated on the 345,000-volt transmission lines using 1.602-inch ACSR "Chukar" conductor for bringing power from Chief Joseph Dam to

the Puget Sound area, and from McNary Dam to the Portland-Vancouver load center. To transmit additional power from McNary Dam to the Willamette Valley load centers, a second circuit 230,000-volt transmission line from McNary Dam to Santiam, Oreg., substation is under construction.

Additional communication facilities are under construction at various substations to meet the added operational requirements of the system.

SOUTHWESTERN POWER ADMINISTRATION

Douglas G. Wright, *Administrator*



FOR the fiscal year 1955, Southwestern Power Administration received \$2,165,000 in appropriations. After the transfer of \$61,500 from SPA appropriation to the Office of the Solicitor and a transfer of \$775,000 from previously appropriated funds for construction to its current appropriation, a total of \$2,878,500 was available for carrying on the Administration's operation and maintenance program. This amount included \$1,990,000 for the purchase of electric power and energy and for wheeling charges. Additional funds amounting to \$1,458,625 remained available for completion of the Administration's construction program.

POWER RESOURCES

The installed and dependable generating capacity in the hydro-electric plants as of June 30, 1955, is shown in the following table:

Existing power installations

Project	River basin	Capacity	
		Installed	Dependable
Interconnected system operation:		<i>Kilowatts</i>	<i>Kilowatts</i>
Bull Shoals.....	White.....	160,000	130,000
Denison.....	Red.....	70,000	60,000
Fort Gibson.....	Grand.....	45,000	48,000
Norfolk.....	White.....	70,000	63,000
Tenkiller Ferry.....	Illinois.....	34,000	30,000
Subtotal.....		379,000	331,000
Isolated plants:			
Narrows.....	Ouachita (Red).....	17,000	17,000
Whitney.....	Brazos.....	30,000	28,000
Subtotal.....		47,000	45,000
Total.....		426,000	376,000

This capacity of 426,000 kilowatts will be augmented by 75,000 kilowatts when Blakely Mountain project on the Ouachita River comes into production, approximately September 1, 1955, thus increasing installed capacity to 501,000 kilowatts.

ENERGY PRODUCTION

The adverse water conditions which have existed in the SPA area since May 1952, continued through December 1954. The last 6 months of this period of low stream flow were the most critical experienced. Stream-flow conditions improved markedly in the period from January 1955 through June 1955, with the total volume of stream flow for the year near normal.

As shown in the following table, the five reservoirs of the interconnected system have had below-normal inflow for 30 months of the past 3 years. The volume of flow during the period, July 1, 1954-January 1, 1955, was less than one-half normal flow. As a result, the water levels in all projects, which were very low in June 1954, continued to recede through December 1954.

Project	Percent of median flow		
	July 1952 to July 1955	July 1954 to Decem- ber 1954	July 1954 to July 1955
Bull Shoals.....	69	116	99
Denison.....	94	29	95
Fort Gibson.....	35	32	37
Narrows.....	100	138	103
Norfolk.....	68	42	70
Tenkiller Ferry.....	76	42	88
Whitney.....		27	34
Total.....	65	51	80

Due to the unprecedented low-flow conditions, it was necessary to defer a portion of the contract obligations of the utilities, reduce the amount of energy delivered to our customers, and purchase excess energy from the generation and transmission cooperatives in the area.

Stream-flow conditions became increasingly better after January 1, and by April 1 conditions were such that normal operations were resumed. All the pools were full by June and stream-flow conditions permitted the sale of secondary energy, and the return of some deferred energy, with a reasonable expectation of being able to return deferred energy during the summer.

Net generation within the SPA area during the 1955 fiscal year was 589,116,320 kilowatt hours, 529,827,340 kilowatt hours of which was from the interconnected system. The net generation and annual primary energy for each project is given below.

Project	Annual primary energy (kilowatt-hours) ¹	Fiscal year 1955 net generation (kilowatt-hours)
Interconnected system operation:		
Bull Shoals.....	414, 400, 000	241, 117, 000
Denison.....	140, 000, 000	140, 319, 000
Fort Gibson.....	² 78, 800, 000	70, 698, 900
Norfolk.....	116, 000, 000	23, 744, 900
Tenkiller Ferry.....	² 51, 300, 000	53, 947, 540
Subtotal.....	600, 500, 000	529, 827, 340
Isolated plants:		
Narrows.....	18, 400, 000	29, 232, 980
Whitney ³	33, 200, 000	30, 056, 000
Subtotal.....	51, 600, 000	59, 288, 980
Total.....	652, 100, 000	589, 116, 320

¹ Former critical period.

² Data from Corps of Engineers Cost Allocation Report 1955.

³ In commercial operation June 1, 1955, energy generated from testing and irrigation releases remainder of year and sold under interim agreement.

ENERGY DELIVERIES

Southwestern Power Administration delivered power and energy to preferred customers directly over its lines and through the facilities of the Texas Power & Light Co., the Southwestern Gas & Electric Co., the Public Service Co. of Oklahoma, the Oklahoma Gas & Electric Co., the Central Electric Power Cooperative, the Western Farmers Electric Cooperative, the M & A Electric Power Cooperative, and the N. W. Electric Power Cooperative.

During the year a contract was executed and service initiated to one new preferred customer, the city of Lamar, Mo., for 500 kilowatts, and contracts were amended providing for increases in contract demand and contract obligation of 35,550 kilowatts. The increase in contract demands consisted of 3,300 kilowatts to distribution cooperatives and 100 kilowatts to one municipality. Contract obligations were increased by 32,150 kilowatts to the Federated Cooperatives through a series of interim agreements. Contracts were also amended to provide for six new points of delivery for existing preferred customers and to abandon five delivery points. In addition, service began to the Brazos Electric Power Cooperative whereby they would receive the output of the Whitney Dam project, an isolated project on the Brazos River.

At the end of fiscal year 1955, the sum of the obligations to and contract demands of all preferred customers served by SPA amounted to 223,410 kilowatts, and were comprised of the following:

	<i>Kilowatts</i>
Rural electric distribution cooperatives (contract demands)-----	33,270
Federated cooperatives (maximum contract obligation)-----	151,500
Military installations (contract demands)-----	9,900
Municipalities (contract demands)-----	28,740

During the fiscal year 577.3 million kilowatt-hours of electric energy were sold to preferred customers; equivalent to 103.6 percent of the total of 557.2 million kilowatt-hours of hydroelectric energy marketed by this Administration. Purchases of thermal electric energy for integration with hydroelectric energy amounted to 192.9 million kilowatt-hours, and energy purchased by the Oklahoma utility companies still deferred as to delivery at the end of the fiscal year amounted to 27.4 million kilowatt-hours, making a total of 777.5 million kilowatt-hours sold. Of this amount, 74.3 percent was sold to preferred customers. At the end of the fiscal year, the Arkansas Power & Light Co. was entitled to 217.7 million kilowatt-hours under the aluminum contract, which was deferred as to purchase and delivery.

Revenue from sales by this Administration during the fiscal year amounted to \$4,063,108. This amount included sales to preferred customers of \$3,049,462, and sales to private utility companies of \$1,013,646.

By the end of the fiscal year, wholesale power and energy generated by the hydroelectric facilities under the marketing jurisdiction of SPA were being sold to 16 distribution cooperatives, 20 municipalities, 5 private utilities, 5 United States military installations, and 7 federated cooperatives.

CONTRACT NEGOTIATIONS

Contract negotiations were completed on an amendment to the electric service agreement between the Government and the Oklahoma Gas & Electric Co. and the Public Service Co. of Oklahoma whereby the companies will supply the supplemental requirements of Government's customers served under the Oklahoma contract through the same facilities utilized to provide electric service for the account of the Government.

Negotiations on similar arrangements were initiated with the Texas Power & Light Co. and it is expected that they will be completed in the early part of fiscal year 1956.

Contract negotiations were completed with the Arkansas Power & Light Co. for the disposal of the entire output of the Blakely Mountain Dam. Under the terms of the agreement the entire output of the

project will be delivered to the company, as scheduled by the company. In return, the company will deliver to the Government on the system of the Government, as scheduled by the Government, an amount of power and energy equal to the installed capacity of the project, and all of the primary energy plus one-half of the secondary energy.

Contract negotiations were continued with five generation and transmission cooperatives in Missouri and Oklahoma on long-term arrangements to replace the lease option and power sales agreements between the cooperatives and the Government, rendered inoperative by the action of Congress in withholding funds necessary to implement the contracts. Interim contracts were made with the cooperatives to transmit Government power over the facilities of the cooperatives, to purchase certain amounts of thermal energy generated at the cooperative's steam plants, and to supply the additional power requirements of the cooperatives.

Because of the drought in the Southwestern area, a new critical water period existed for most of the reservoir projects from which this Administration markets power, which greatly curtailed the amount of power and energy available for sale. Contractual and operating arrangements were made with private utility companies in the area so as to reduce the amount of energy that this Administration was obligated to deliver to the companies during the critical water period. This action resulted in the Administration being able to fulfill all of its obligations to preferred customers without affecting service to other power customers in the area.

REORGANIZATION

As a result of a survey conducted by a team selected for that purpose, Southwestern Power Administration has undergone a reorganization and a reduction in staff during the fiscal year ended June 30, 1955. The staff now consists of 101 employees, 53 less than were employed at the beginning of the fiscal year. The organization is broken into four segments—the Office of the Administrator, the Division of Administrative Services, the Division of Operations and Engineering, and the Division of Rates and Customer Service. The reorganization is virtually complete on this date.

As a result of this reorganization and attendant changes in activities, this Administration reduced its stores and equipment by 17 percent and its leased office and warehouse and storage space by 12,778 square feet and 54,920 square feet, respectively.

FEDERAL CIVIL DEFENSE ACTIVITIES

Departmental Order 2751 designated the Administrator of Southwestern Power Administration as coordinator for all bureaus of the

Department of the Interior in the Fifth Federal Civil Defense Region (consisting of the States of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) with the Federal Civil Defense Administration on Departmental assistance in event of major disaster or other emergency situations. In this connection, SPA collected, cataloged and coordinated the Department's capabilities in this region and represented the Department in this coordinating capacity with the FCDA in the preparation for and during Operation Alert—1955.

SPA also provided counterpart service to the FCDA regional office on electric power during the alert, initiating interest and securing cooperation of interconnected power systems in the Southwestern area.

As a result of the Blackwell, Okla., tornado, which occurred on May 25, 1955, FCDA requested and Southwestern Power Administration provided engineering services in a study to determine the extent of damage and estimated cost of temporary repairs to the electric distribution of this town.

SOUTHWEST FIELD COMMITTEE

During the past year, the Southwestern Power Administration has participated with the other bureaus of the Department in the activities of the Southwest Field Committee. Through its membership on this Committee and its representation on the Inter-Agency Committee, the Southwestern Power Administration has urged consideration of present planning to meet future needs. At the request of Southwestern Power Administration, the following statement was included in the annual program report of the Southwest Field Committee:

Comprehensive planning should provide for the inclusion of storage space to meet reasonably certain future water requirements. As a system of reservoirs approaches completion, flood storage requirements may be reduced by additional levees, channel alignment improvements, and upstream land treatment programs. In addition, the power storage may be reduced as fewer hours of hydroelectric energy will be required per kilowatt of capacity due to optimum utilization of the system to meet peaking demands. These reductions in storage requirements would permit reallocation of storage capacity to meet changing requirements for water. This would permit the realization of greater future benefits through the provision of domestic, municipal, industrial, and irrigation water supplies. For example, the authorized plan for the White River Basin has no provision for storage space in reservoirs to provide water for consumptive use although it is estimated that 2¼ million acre-feet will be required annually to meet irrigation needs. A major reallocation will eventually be required to provide storage for water for consumptive use.

The Southwestern Power Administration participated in a special meeting in the office of the Chief, Technical Review Staff, to review

and comment on the program reports of the several field committees of the Department. The meeting provided the basis for improvement in such reports and in their underlying studies. The analytical review should be continued in order to improve the cooperation within the Department and to further the partnership relation between these regional representatives, interagency committees, and State and local representatives.

ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE

Representatives of the Southwestern Power Administration participated during the year with officials of the other bureaus of the Department, other Federal agencies, and the States in planning for the development of the land and water resources of the Arkansas-White-Red River Basins. The Southwestern Power Administration also participated in the work of the various subcommittees and work groups, and directed the activities of the transmission subgroup of the hydroelectric power work group.

During the past year, the activities of the Arkansas-White-Red Basins Inter-Agency Committee have been concentrated on drafting the various sections of the report, reviewing and revising these sections and the adoption of the final draft of each of the sections. During this period, representatives of the Southwestern Power Administration participated in the drafting of the Hydroelectric Power Section and in the review of the other sections in which it had a related interest. Through its membership on the Southwest Field Committee of the Department of the Interior, it has participated directly in the preparation and approval of the final sections of the Arkansas-White-Red report.

On June 28, 1955, the Arkansas-White-Red Basins Inter-Agency Committee held its final meeting and all subgroup assignments terminated as of that date. The report has been reproduced and forwarded through channels for consideration by the Inter-Agency Committee on Water Resources.

At the June 28 meeting, a charter was presented creating a new Inter-Agency Committee to continue the studies of resource development in the Arkansas-White-Red River Basin area. The Southwestern Power Administration will actively participate in the performance of the duties of the new committee.

The accomplishments of Arkansas-White-Red Basins Inter-Agency Committee during the past 5 years have shown the need for this type of organization in planning for the conservation and development in

land and water resources and in encouraging a partnership between the Federal, State, and local agencies. The basic plan has been established by the old committee, and will be implemented, improved, and modified by the new committee.

LITIGATION

In *Kansas City Power & Light Company et al. v. McKay* (substituted) *et al.*, the District Court of the District of Columbia upheld the validity of numerous complicated contracts between Southwestern Power Administration and various rural electric cooperatives in Missouri. The plaintiffs appealed from the final judgment entered in the case. Thereafter, the Court of Appeals, District of Columbia Circuit, vacated the judgment and remanded the case to the district court with directions to dismiss the complaint. The cause is now pending on plaintiff's petition for rehearing.

In *Central Electric Power Cooperative v. McKay et al.*, a suit for declaratory judgment, the District Court for the District of Columbia rendered judgment for the plaintiff. The Interior Department Appropriation Act, 1954, provided for the use of a certain fund in making purchases of electric power and energy and in making payments of rentals for the use of transmission facilities. The court, contrary to the contention of the defendants, adjudged the fund to be available for use in carrying out a power purchase contract and a transmission line rental contract which the plaintiff had with the Government. The defendants appealed to the Court of Appeals, District of Columbia Circuit, which court reversed the decision of the district court and remanded the case to that court with directions to dismiss.

In *Kansas City Power & Light Company, et al v. N. W. Electric Power Cooperative, Inc., and Douglas G. Wright, Administrator of Southwestern Power Administration* (Docket No. 12,095, before the Public Service Commission of Missouri), six privately owned electric utility companies sought to require the cooperative to obtain a certificate of convenience and necessity for construction and operation of a thermal generating plant and transmission system in Missouri, and to require the Administrator of SPA to comply with the rules and regulations of the Commission with respect to the sale and transmission of electric power and energy in Missouri. Counsel for the Administrator of SPA appeared specially before the Commission on March 23, 1951, and moved for dismissal of the proceeding on jurisdictional grounds. Thereafter, counsel for the cooperative appeared specially and moved for dismissal on similar grounds. Briefs of the defendants and complainants were subsequently filed. Parties are still awaiting the ruling of the Commission upon these motions.

SOUTHEASTERN POWER ADMINISTRATION

Chas W. Leavy, *Administrator*



THE hydroelectric output marketed by the Southeastern Power Administration in fiscal year 1955 consisted of 915,700 kilowatts of capacity and 2,130,249,513 kilowatt-hours of energy. It was sold to two public bodies, seventeen rural electric cooperatives, one Federal agency, and four privately owned utilities. The sales earned \$9,783,104.81, an increase of \$1,852,081.59 over earnings of the previous year, and brought revenues earned in all years to a total of \$31,736,242.63.

The output was generated at seven Corps of Engineers projects. They were the Wolf Creek, Dale Hollow and Center Hill projects in Kentucky and Tennessee, the Allatoona project in Georgia, the Clark Hill project in Georgia and South Carolina, the John H. Kerr project in Virginia and North Carolina, and the Philpott project in Virginia. Generating capacity at these projects was increased during the year to an amount just beyond the 1 million mark. Construction by the corps also went forward on four other projects (Jim Woodruff in Georgia and Florida, Buford in Georgia, and Old Hickory and Cheatham in Tennessee) that are to have an installed capacity totaling more than a quarter of a million kilowatts.

The combined output of Wolf Creek, Center Hill, and Dale Hollow was sold to the Tennessee Valley Authority under a long-term contract. All power generated at Allatoona was sold under a long-term contract to the Georgia Power Co. Part of the Clark Hill output was sold under long-term contracts to two public bodies in South Carolina, and part of the Kerr projects output was sold under long-term contracts to the Virginia Electric & Power Co. and to 17 rural electric cooperatives in Virginia and North Carolina. The remainder of the Clark Hill and Kerr output, and all of the Philpott output, was sold under temporary arrangements pending the conclusion of negotiations for long-term sales. These negotiations were in progress as the year ended.

Application was made for Federal Power Commission approval of rates for the sale of Allatoona, Clark Hill, Kerr, and Philpott power. Rates for Kerr and Philpott were approved. Action by the Commission was not completed during the year on the remaining applications. Rates for the sale of Wolf Creek, Dale Hollow, and Center Hill power were reviewed with the Tennessee Valley Authority and agreement was reached on an increase in average annual payments from \$3,500,000 to \$3,950,000.

The Congress appropriated \$233,800 for headquarters operation and maintenance, and \$978,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 45 employees at the beginning of the year and 33 employees when the year ended.

DEFENSE ELECTRIC POWER

Office of Assistant Secretary—Water and Power
Development, Department of the Interior

Fred G. Aandahl, *Assistant Secretary*



PROGRAM

ACTIVITIES in the Defense Electric Power field can be summarized as follows:

General supervision of electric power supply expansion (including the generation, transmission, distribution and utilization thereof) to assure an adequate power supply for the Nation under partial and full mobilization conditions. In detail they include, among others: assembling and evaluating data as to the production capacity of electric utilities and the supplying of electric power under mobilization conditions; serving as an allotting agency and providing recommendations as to scheduling and expediting, to assure delivery of materials and equipment to the electric power industry for the power expansion program to provide power to Atomic Energy Commission installations; recommending establishment or modification of expansion goals, and screening and making recommendations to the Office of Defense Mobilization on requests for accelerated tax amortization for electric power facilities under expansion goals established by the Office of Defense Mobilization; and conducting various activities concerned with departmental and electric power industrial functions in the event of an emergency to insure a continuity of essential electric power.

AUTHORITY

The administration of functions dealing with electric power is vested in the Secretary of the Interior under the Defense Production Act of 1950, as amended; Executive Order 10480 of August 15, 1953, as amended; and Office of Defense Mobilization Order I-13 of November 12, 1954, DMO I-7 and DMO VII-5.

POWER SUPPLY

The year-end peak capabilities, peak loads, and reserve margins for the Nation as a whole are shown in table I, and graphically in exhibit A. Figures for the years 1949 through 1954 are actual, while those for the years 1955 through 1958 are as presently scheduled and planned. The capabilities reflect existing construction schedules and present plans of individual power systems for bringing new power projects into commercial operation. Present scheduling and planning indicate that there will be brought into service 13.0 million kilowatts in 1955, 8.0 million kilowatts in 1956, 7.7 million kilowatts in 1957, and 11.0 million kilowatts in 1958. Scheduling for the years 1957 and 1958 is incomplete. With incentive through rapid tax amortization, additional installations can be anticipated. Without this incentive, it can be anticipated that the installation of many units will be slipped to later years and the peak capabilities as shown in table I and exhibit A will not be attained.

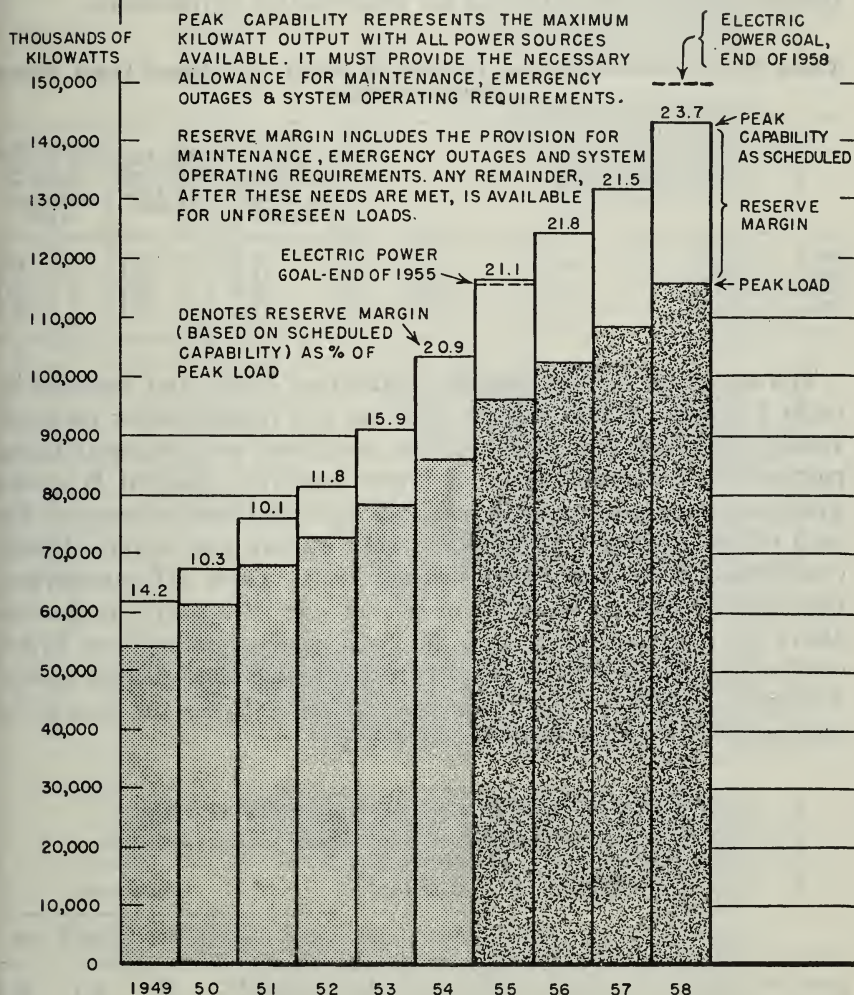
TABLE I.—*Total United States December maximum peak capabilities, peak loads and margin of reserves*

Year	Capabili- ties (million kilowatts)	Loads (million kilowatts)	Reserves (percent of loads)
1949 actual.....	61.9	54.2	14.2
1950 actual.....	67.7	61.4	10.3
1951 actual.....	75.0	68.1	10.1
1952 actual.....	81.5	72.9	11.8
1953 actual.....	91.0	78.5	15.9
1954 actual.....	103.6	85.7	20.9
1955 estimated.....	116.6	96.3	21.1
1956 estimated.....	124.6	102.3	21.8
1957 estimated.....	132.3	108.9	21.5
1958 estimated.....	143.3	115.8	23.7

The Federal Power Commission and the Department of Interior have concurred in the estimated capability figures as shown above. Department of Interior figures include both scheduled and planned units, whereas Federal Power Commission's capacity figures include only firm scheduled units based on adverse water conditions.

The year-end peak capabilities for the Nation as a whole for the years 1955 through 1958 are based upon median hydro conditions. For adverse hydro conditions the reserve margins above estimated peak loads are less. Table II summarizes the nationwide reserve in terms of percentage of capacity in reserve above the estimated peak loads under adverse hydro conditions, as reported by the Federal Power Commission, the Edison Electric Institute, and the Defense Electric Power Staff. The differences are due to the date of reporting and the units included. The Federal Power Commission include

DEPARTMENT OF THE INTERIOR
OFFICE OF ASST. SECY. FOR WATER & POWER
AUGUST 1955



TOTAL U.S. DECEMBER PEAK CAPABILITIES, PEAK LOADS AND
RESERVE MARGINS—MEDIAN HYDRO CONDITIONS

EXHIBIT "A"

as of June 30, 1955, all units definitely scheduled as reported by the utilities. The Edison Electric Institute include as of April 15, 1955, all units both definitely scheduled and tentatively planned (orders for equipment may or may not have been placed) as reported by the utilities. The Defense Electric Power Staff include as of September 1, 1955, all units definitely scheduled and tentatively planned including information from recent rapid tax amortization applications.

TABLE II.—*Nationwide reserves (percent of loads) for adverse hydro during December peaks*

End of year—	Federal Power Commission as of June 30, 1955	Edison Electric Institute as of April 15, 1955	Defense Electric Power Staff as of September 1, 1955
1955.....	18.8	18.9	19.0
1956.....	18.4	19.3	19.9
1957.....	16.3	18.4	19.4
1958.....	12.1	17.1	21.6

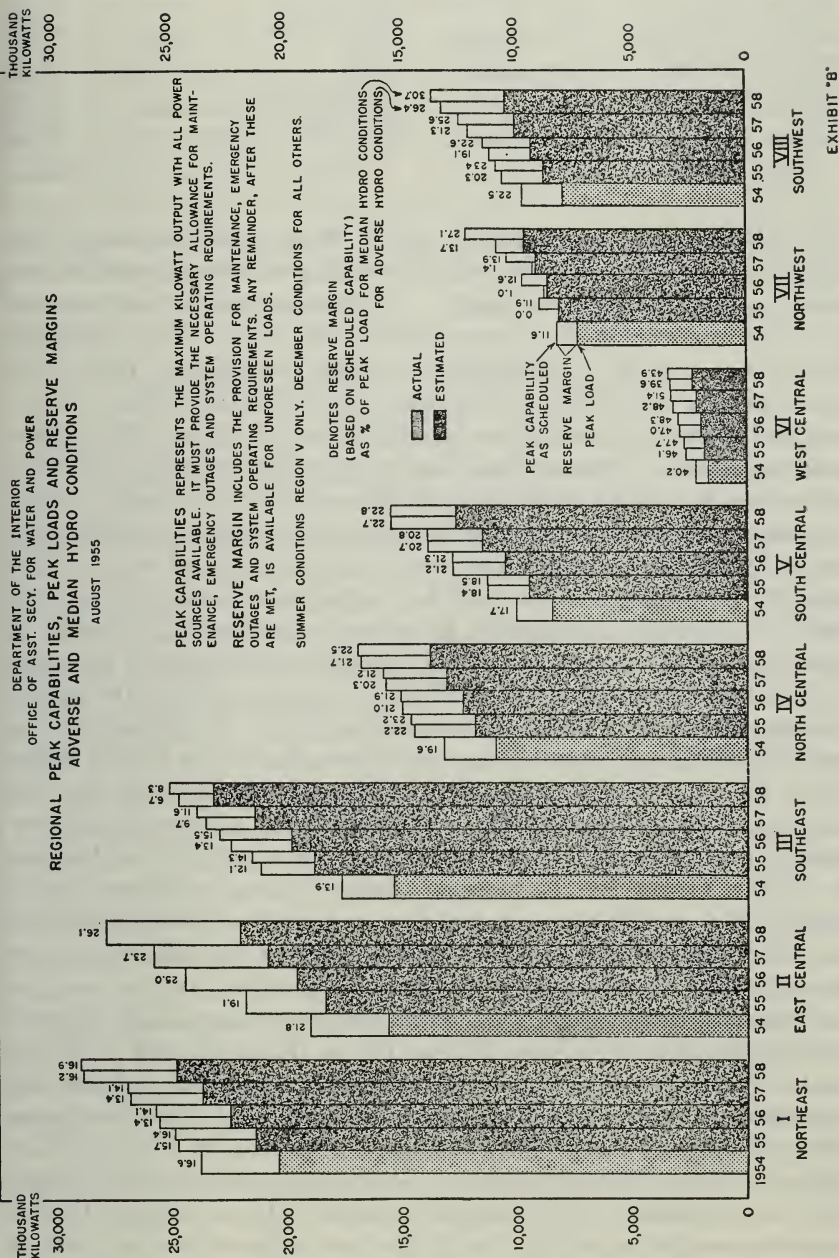
The statistics for nationwide capabilities, loads, and reserves in table I and exhibit A, do not point up the regions below national average and therefore do not reflect conditions on a regional basis, particularly indicating areas of lowest reserves. Exhibit B shows graphically the peak capabilities, peak loads and reserve margins for each of the regions I to VIII for both median and adverse hydro conditions for the years 1954 through 1958. Table III summarizes the regional reserves in terms of percentages of capacity in reserve above the estimated peak loads for both median and adverse hydro conditions. The situations shown are for year-end conditions except for region V, which is for summer conditions as this is the time of its regional peak load due to air conditioning.

TABLE III.—*Regional reserves as percentage of loads*

[December Peaks shown for all Regions except V which is for summer conditions]

Region	Median hydro				Adverse hydro			
	1955	1956	1957	1958	1955	1956	1957	1958
I.....	16.4	14.1	14.1	16.9	15.7	13.4	13.4	16.2
II.....	19.1	25.0	23.7	26.1	19.1	25.0	23.7	26.1
III.....	14.3	15.5	11.6	8.3	12.1	13.4	9.7	6.7
IV.....	23.2	21.9	21.2	22.5	22.2	21.0	20.3	21.7
V.....	18.5	21.3	20.8	22.8	18.4	21.2	20.7	22.7
VI.....	47.7	48.3	51.4	43.9	46.1	47.0	48.2	39.6
VII.....	11.9	12.6	13.9	¹ 27.1	0	1.0	1.4	¹ 13.7
VIII.....	23.4	22.6	25.6	30.7	20.3	19.1	21.3	26.4

¹ The large increase in reserves for the year 1958 is due to the scheduled and planned installation of 1,823,500 kilowatts in that year versus installation of 876,300 kilowatts in 1955, 687,500 kilowatts in 1956, and 689,700 kilowatts in 1957.



The scheduled and planned installations for 1958 are:

Idaho Power Co.....	Thermal.....	3 units.....	500,000
Do.....	Hydro.....	Brownlee No. 1.....	103,100
Do.....	do.....	Oxbow No. 4.....	43,400
Pacific Power & Light Co.....	do.....	Swift River Nos. 1, 2, 3, 4.....	264,000
Do.....	Thermal.....	1 unit.....	100,000
Portland General Electric.....	do.....	1 unit.....	150,000
Do.....	Hydro.....	3 units.....	75,000
Tacoma, Wash.....	do.....	Mayfield Nos. 1, 2, 3.....	120,000
U. S. Corps of Engineers.....	do.....	Chief Joseph Nos. 13, 14, 15, 16.....	256,000
Do.....	do.....	Dalles Nos. 3, 4, 5, 6.....	312,000
Utah Power & Light Co.....	Thermal.....	1 unit.....	100,000
Total.....			1,823,500

In other regions, particularly in the South and Southwest, the expanding use of air conditioning is causing summer loads that are closely approaching winter peaks. On some systems within these regions the summer loads already exceed the winter loads, although the effect is not as yet sufficient to change the regional peak from winter to summer. This general change in the characteristics of summer loads in many areas is creating additional problems with maintenance programs. Summer peaks are governed by weather conditions and cannot be closely predicted as in the case of winter peaks. Summer peaks may occur frequently throughout the summer months, making it difficult to schedule and carry out maintenance work. This situation is resulting in the need for larger reserve margins in some areas to assure the availability of adequate generating capacity to meet the more frequent peaks now occurring throughout the year.

Referring again to table II, it should be pointed out that the figures for the country as a whole under adverse hydro conditions have no special significance, as experience has shown that in the United States severe droughts are not usually experienced country-wide but are confined to limited areas. On a regional basis, adverse hydro conditions (see table III) have little effect on capability in Regions I, II, IV, V and VI. Assuming adverse hydro conditions should exist in Region III, the estimated loss in December peak capabilities would be less than two percent in 1955 and in the following years through 1958 the percentage loss would diminish. In the event of shortage of power in region III, additional power is available through transmission ties to regions II and IV on the north and V on the west. For region VII (Pacific Northwest), it is estimated that adverse hydro conditions would cause a decrease in the December capability of approximately 950,000 kilowatts in 1955 to 1,270,000 kilowatts in 1958. This represents losses varying from approximately 10.3 to 11 percent. As indicated in table III and exhibit B, this would lower the capability in 1955 to just equal to the load, but in 1956 there would result one percent reserve, in 1957—1.4 percent and in 1958—13.7 percent. As region VII capabilities are predominantly hydro rather than steam, the region needs considerably less in reserve

capability than other regions. A reserve capability of 4 percent in region VII should be as adequate as a 10 percent reserve capability in region II where the capability is almost entirely from steam generation. In region VII there is also a considerable amount of contractually interruptible load. It is estimated that all noninterruptible loads can be carried without curtailment and most of the interruptible loads in 1955 through 1957. The capabilities and reserves for 1958 presently appear to be adequate. In region VIII, adverse hydro conditions would cause a decrease in estimated December peak capability ranging from 2.5 percent in 1955 to 3.3 percent in 1958. Estimated reserve margins, however, are adequate to accommodate such conditions should they be encountered.

AEC-RELATED POWER PROJECTS

The Office of the Assistant Secretary—Water and Power Development is also the allotting agency for atomic energy related projects, familiarly known as E-5 rated projects. This program provides allotments and priority assistance on materials and equipment for construction of facilities to furnish interim, firm and backup power to Atomic Energy Commission installations. It consists of 52 projects, containing 89 units with nameplate ratings totaling 10,721,000 kilowatts. These were designated as essential to supply power to Atomic Energy Commission installations. Allotments of steel, copper, and aluminum on quarterly bases are issued as required for each project. Assistance is given through expediting shipments of materials and scheduling deliveries of equipment.

Since the program started in 1953, a total of 8,738,000 kilowatts have been placed in service as of September 1, 1955. The program is presently 285,000 kilowatts behind the original schedule which was set up in November 1952. The greatest slippage was 2,319,000 kilowatts in May 1954 and large slippages continued through October 1954, at which time it amounted to 2,266,000 kilowatts. Subsequently the slippages have gradually decreased and the program is presently almost back to the original schedule. Exhibit C shows graphically the kilowatts as originally scheduled to be in service, the kilowatts as actually brought into service, and present schedule for completion of the program. The delay in the program was due principally to slippages in some turbine deliveries. The delay in the program resulted in the Atomic Energy Commission purchasing interim power from whatever sources available at higher costs than would have been necessary if the E-5 rated units had been brought into service as originally scheduled. Under present planning the program will be completed by June 1956 with total installation of 10,721,000 kilowatts.

EXPANSION GOALS

The Electric Power Goal No. 55, as revised and issued on August 26, 1952, called for the installation of 41 million kilowatts of new generating capacity in class I utility systems or a total of 116 million kilowatts by the end of 1955 and 1 million kilowatts for certain defense related projects in 1956. Present indications are that the total installed capacity by the end of 1955 will slightly exceed 116 million kilowatts.

On December 3, 1953, the Office of Defense Mobilization by its order VII-6 temporarily placed the electric power goal on the suspended list.

On July 29, 1954, the Acting Secretary of the Interior recommended to the Office of Defense Mobilization that the goal be closed with certain minor exceptions. This recommendation was made in response to a request by ODM for a reexamination of the power situation. Under the then-assumed circumstances of partial mobilization it was considered that reserve margins were sufficient to meet the needs in all regions with the possible exception of the Pacific Northwest.

Present estimates now indicate that the reserve capacity, assuming the same conditions and circumstances as above, will, for the years 1955 through 1958, be in excess of 20 percent which is considered more than adequate under partial mobilization conditions.

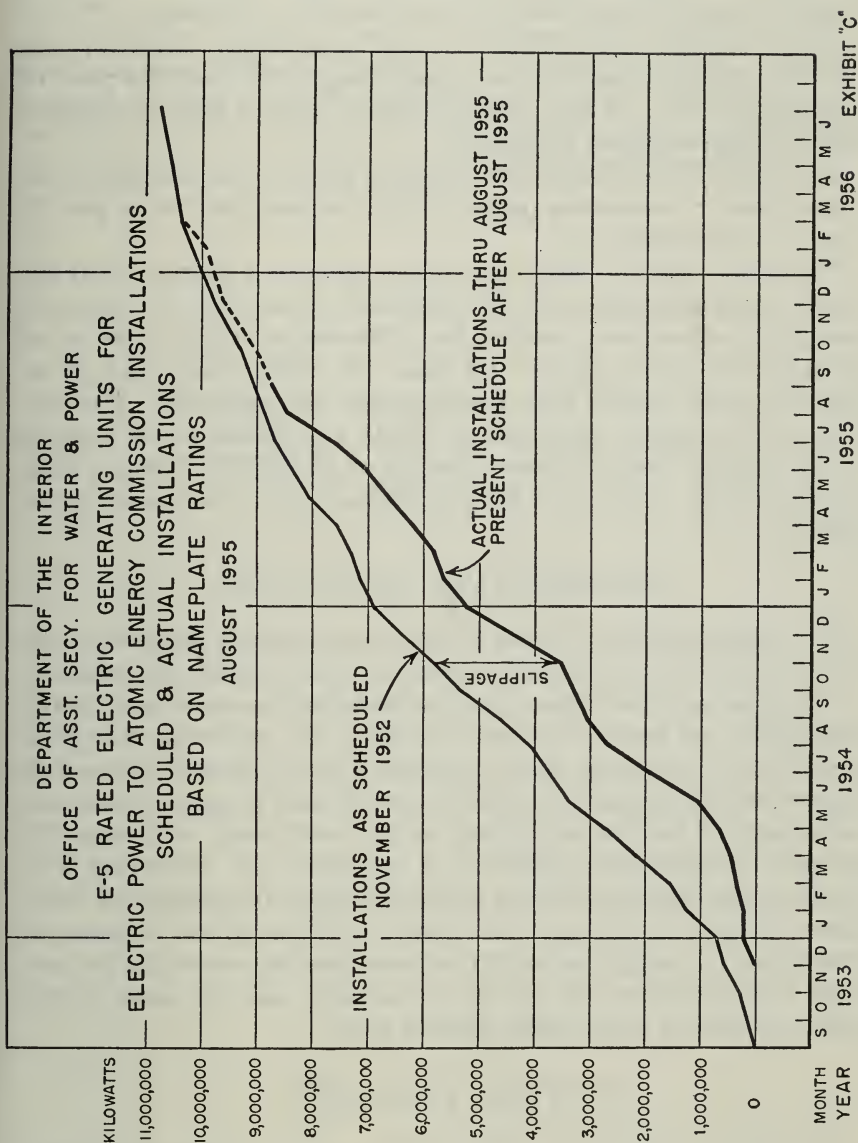
However, during conferences in March and early April of this year between officials of ODM and Interior, agreement was reached that planning should be premised on—not partial—but full mobilization which would then be in accord with other defense-planning agencies.

Accordingly, on April 15, ODM by its order VII-6, amendment 11, transferred goal 55—electric power—from the suspended to the open goal. This amendment also enlarged and extended the goal to 150 million kilowatts by the end of 1958. This represents an increase of approximately 34 million kilowatts over the expected capacity additions planned to be installed by the end of this year.

On August 11, 1955, goal 55—electric power—along with 37 other goals was placed on the suspended list by Defense Mobilization Order VII-6, supplement 1, pending review to determine whether adequate productive capacity exists to meet defense mobilization needs.

The Office of Defense Mobilization by its order—DMO VII-6, Supplement 3, dated September 29, 1955—placed goal 55—electric power—on the open list. Applications for necessity certificates under the electric power goal must be filed at the Office of Defense Mobilization by the close of business December 31, 1955, to be eligible for consideration.

Expansion goal No. 225, for power facilities for military, atomic energy, and defense-related needs, was established by Defense Mobi-



lization Order VII-6, amendment 9, dated March 17, 1955. This goal covers the following facilities for which there is an existing or prospective shortage to supply power required by the military services, Atomic Energy Commission, or a defense-related industry:

(a) Interconnections between power generating facilities; and
(b) Transmission lines between a generating facility and the point of consumption required by a military service, Atomic Energy Commission, or defense-related industries.

This goal was established primarily to clear up the backlog of defense-related transmission projects which accumulated while goal 55 was on the suspended list.

Through August 31, 1955, under the original and amended goal No. 55 and goal 225, applications for certificates of necessity for rapid tax amortization have been received for 1,036 electric utility projects and 46 industrial power plants. Of these 791 utility plans and 43 industrial power plants were recommended for approval. The certificates of necessity approved by ODM are related to an increase in the Nation's electric power capacity of 24,328,455 kilowatts from electric utility systems and 777,000 kilowatts from industrial power plants.

COOPERATIVE ACTIVITIES

The Defense Electric Power functions also include cooperative activities with other governmental agencies. Some of these activities are:

(a) Reports to the Office of Defense Mobilization on status of goals; capabilities and loads; and special studies; (b) conferring with Federal Power Commission as to capabilities and loads and nationwide maps of utility systems; (c) reporting to Atomic Energy Commission as to status of the E-5 rated program and conferring with respect to rating of projects and expediting of materials; (d) conferring with Business and Defense Services Administration, Department of Commerce, relative to ratings, scheduling of equipment and issuance of directives; (e) conferring with the Geological Survey of the Department of the Interior with respect to mapping; and (f) contacts with public utilities in formulating defense plans.

FUTURE PLANNING

In addition to activities outlined above, plans are being formulated for the activation of a defense electric power agency at a relocation center in the event of an emergency and the formation of field organizations that can be activated in the event of war in order to assure a continuation of essential electric power supply. Maps and operating information as to individual electric systems are being accumulated for use in such an emergency.

PERSONNEL

This defense electric work is handled for the most part by three full-time employees. When the workload rises sharply, as it has occasionally over the past 2 years, the Department's Technical Review Staff provides additional personnel on a temporary basis. Industry consultants have also been called upon to assist. Consultants have been known for the most part to work on studies requiring specialized knowledge in power matters in particular areas of the country.

SALINE WATER CONVERSION PROGRAM

David S. Jenkins, *Director*



IN RECENT years there has been a tremendous increase in demand for large quantities of fresh water, brought about by the continued expansion of our industries, population and agriculture. In recognition of this need and in view of the potential benefits to be gained, Congress, in 1952, authorized the saline water conversion program for an initial period of 5 years. That act (66 Stat. 328, 42 U. S. C., sec. 1951) has as its primary objective the development of economically feasible processes for converting saline water to fresh water, suitable for agricultural, industrial, municipal and other uses, to conserve and increase the water resources of the Nation. In view of initial partial success in development of improved processes and the recognized need for uninterrupted research over a longer period, the Congress extended the authorization to 1966, during 1955.

The activity was designed by the Congress to be, and is, a wholly cooperative endeavor with private scientific, educational and industrial institutions and individuals. The Department carries out the program by: (1) stimulating the interest of private and public organizations and individuals in the problem and encouraging research and development by correlating and coordinating activities in this field, and (2) conducting scientific research and development by means of federally financed grants and contracts and by a limited amount of research in Federal scientific organizations.

The research and development work is coordinated with the Department of Defense, the Atomic Energy Commission, the Civil Defense Administration, National Science Foundation, Smithsonian Institution, Department of Agriculture, Department of State, Department of Commerce, and the International Cooperative Administration. The work is coordinated with that in foreign countries, and cooperative research is carried out with a European working party and desalting of water.

Progress is being made toward the development of economically feasible processes for converting large quantities of saline water to fresh water. However, the cost obstacle is very great and overcoming it will doubtless require a number of years of both research and development. The work accomplished to date indicates that the cost objectives are being approached and it is believed they can be reached, and with continued research and development, the costs may be lowered still further.

Physical processes are being investigated by several contractors. Various aspects of the distillation process, for example, are being studied and the development of Dr. K. C. D. Hickman in conjunction with the Badger Manufacturing Co. shows considerable promise. This devise is a vapor compression still, but by utilizing agitation, reduced pressure, and thin films of water, the heat transfer coefficients have been increased severalfold over what has been considered practicable heretofore. The design of a large integrated prototype (25,000 gallons per day) is essentially complete and the fabrication of this unit is being considered.

Another promising distillation process being investigated by the Department under a contract with Nuclear Development Corp. of America utilizes extremely high temperatures and pressures to obtain a phase separation of dissolved salt from sea water at the critical region of water. Results obtained during the past year indicate that this method is feasible under static conditions. Corrosion and scaling are serious problems, however, and are being studied before proceeding further.

Still another distillation process, solar distillation, is being investigated by the Department through contractors, Dr. George O. G. Löf, Denver, Colo.; New York University; and Bjorksten Research Laboratories.

Investigations in the field of freezing as a demineralization technique are being conducted at Applied Science Laboratories, University of Washington, and Battelle Memorial Institute.

Development of demineralization processes based on some form of osmosis is being studied by several contractors. For example, the University of Florida is investigating reverse osmosis. Water is forced through a membrane by pressure, applied to the saline solution, but the salt is held back by a semipermeable membrane. Although the flow rate is small, several membranes studied will remove 90 per cent or more of the salt from sea water in one pass. Research on membrane improvement and on the theory and mechanism involved is continuing.

Dr. G. W. Murphy, the State University of New York Research Foundation, under contract with the Department, has designed and de-

veloped an osmotically powered cell for demineralizing brackish water. Recent work has been concerned with improving the cell design.

A method involving solvent extracting is being investigated by the Department under contract with Texas A. and M. Research Foundation. Results to date indicate that a process of this type is technically feasible.

A promising electrical process being developed by Ionics, Inc., under contract with the Department, utilizes cation and anion permselective membranes. Following two earlier laboratory developments, exhaustive field tests on irrigation water in Arizona were recently completed with a trailer-mounted unit. Many problems were encountered before the salt content of the water was reduced from 4,600 parts per million to 350 parts per million. After completion of this 6-month test the unit will be moved to Miller, S. Dak., for operation on salty municipal water.

The results of these field tests will furnish reliable data for cost estimates, and conclusions regarding durability of components, frequency of, and reason for shutdowns, etc.

Progress made to date is sufficiently encouraging to indicate that if the activity is given sufficient time, economic processes for demineralization of sea water and brackish water may be developed.

OFFICE OF THE ASSISTANT SECRETARY MINERAL RESOURCES

Felix Edgar Wormser, *Assistant Secretary*



THE Assistant Secretary for Mineral Resources discharges the responsibilities of the Secretary of the Interior with respect to the Department's programs in the field of the development and utilization of minerals and metals, including mineral fuels. He exercises supervision over the Geological Survey, the Bureau of Mines, the Defense Minerals Exploration Administration, the Office of Oil and Gas, the Office of Minerals Mobilization, and the Division of Geography.

The Assistant Secretary is the principal spokesman for Interior in the field of mineral affairs at the policy-making level within the Federal Government. He is the Department's liaison representative on the Council on Foreign Economic Policy, and represents the Department on the Interdepartmental Minerals Advisory Committee, and on other interdepartmental committees concerned with a broad range of mineral problems.

The office coordinates the Department's representation on the interdepartmental advisory committees that the Department of Commerce utilizes in carrying out its responsibilities under the Export Control Act of 1949. Requiring particular attention in this area during the year were situations with respect to iron and steel scrap, copper, aluminum, and nickel.

In addition to the foregoing responsibilities, the Office of Assistant Secretary, Mineral Resources, has become the principal point of contact between the Federal Government and the mineral industries. Real progress was made during the year toward the establishment of a series of industry advisory committees to assist the Department in carrying out its responsibilities in the field of minerals mobilization.

Continued progress was made during the 1955 fiscal year towards implementation of recommendations made by teams of experts that were appointed by the Secretary to survey the operations of the Bureau of Mines and the Geological Survey. Substantial improvement in the management of the Department's activities in the minerals field has resulted, and it is expected that further advances will be made

as the new patterns of organization and improved operating procedures become completely established.

The final report of the President's Cabinet Committee on Minerals Policy was submitted to the President on November 30, 1954. The report was approved by the President on December 1, after discussions with the Cabinet. The Cabinet Committee was composed of the Secretary of the Interior, Chairman, the Secretary of State, the Secretary of Commerce, and the Director, Office of Defense Mobilization. The Assistant Secretary, Mineral Resources, served as the alternate member from the Department of the Interior and, in addition, organized and supervised interdepartmental staff work.

Prior to the submission of the Committee's final report, certain of the basic recommendations were discussed with the President. Of major importance among these was a recommendation designed to strengthen the mobilization base for strategic and critical materials. This received the President's immediate approval and an intensive study of lead and zinc was launched. As a result of this study long-term stockpile objectives were established for these two strategic metals and purchases were begun in June 1954. The purchase program was continued throughout the 1955 fiscal year and during this time its effectiveness as a mobilization device was thoroughly demonstrated. The program brought about an increase in national security in two directions. It increased the physical stocks of lead and zinc on hand and available for emergency needs, and at the same time strengthened the domestic lead and zinc mining industry as a component of the mobilization base. Studies of other mineral commodities were initiated during the year.

On November 12, 1954, pursuant to another recommendation of the Mineral Policy Committee, the Office of Defense Mobilization delegated to the Secretary of the Interior the responsibility for the development of preparedness measures for a comprehensive list of minerals and fuels. The Office of the Assistant Secretary, Mineral Resources took a leading part in the shaping of these delegations.

In January 1955 the Office of Minerals Mobilization was established to carry out the responsibilities included in the delegation. During the remainder of the fiscal year the newly created office in cooperation with the staffs of the Bureau of Mines and the Geological Survey, and under the direction of the Assistant Secretary, entered into intensive study of a number of pressing mineral mobilization problems.

Other important activities of the office during the 1955 fiscal year included continued participation in the Department's program of post-attack planning and participation in Operation Alert. In May and June 1955, the Assistant Secretary made an extended trip through Europe and the Middle East to gain firsthand information on the oil industries in these areas.

GEOLOGICAL SURVEY

W. E. Wrather, *Director*



THE following brief accounts of the activities of the Geological Survey during the past 12 months tell of coordinated effort with many agencies of Government at all levels, many representatives of private industry and countless individuals.

This Nation's wealth is often attributed to the initiative shown by its citizens, to the abundance of its natural resources, and to the manner in which earth's riches are used to build a better future.

Necessary to thriving industry is the timely discovery and conservative use of metals and minerals, availability of power sources, and knowledge of water supplies. Steady growth has been a bulwark of this Nation and a principal wellspring of that growth has been the availability when needed of new knowledge concerning the location, quantity, and accessibility of these resources. This is the Survey's special contribution, the application of scientific and engineering knowledge to meet ever-increasing demands for new sources of raw materials.

To this end nearly 8,000 employees of the Survey are currently engaged in several hundred projects extending throughout the year. They are conducting mineral investigations, mapping, gaging streams, measuring underground waters, administering the mineral- and fuel-leasing laws, and at the same time developing new tools with which to accomplish better, the many contributory tasks involved. The following are summary statements for the principal Survey Divisions:

GEOLOGIC DIVISION

During fiscal year 1955, the Geologic Division continued its study of the geology of the United States and of the mineral resources of the Nation. Emphasis was continued on the development of new and improved methods of exploration for mineral resources, acceleration of geologic mapping, and cooperative geologic investigations with

Federal and State agencies, all supported by a program of basic research.

Notable during the year was the completion of new multicolor geologic maps of New Hampshire, Oklahoma, and Wyoming, all the results of cooperative investigations; completion for the Air Force of a special geologic study of the site for the Air Force Academy at Colorado Springs, Colo.; the completion in manuscript of the first (for the Jurassic system) of a series of paleotectonic maps; completion of field investigations and a core-drilling program for the Department of the Navy of its oil-shale deposits in Naval Oil-Shale Reserve No. 2 in eastern Utah; continued refinement of photogeologic techniques as an aid in more rapid and economical geologic mapping, and the training of 75 geologists in the use of such techniques; the use of gamma-ray well logging as a tool in the search for potash deposits; development of a jeep-mounted scintillation well logger, a hand portable scintillation well logger, and a liquid scintillation core scanner; development of X-ray fluorescence methods for the rapid nondestructive analyses of substances hard to analyze chemically; and the development of the Larsen method of geologic age determination to the routine service stage.

Survey geologists, in cooperation with Bureau of Mines engineers, continued to provide technical data and evaluation in the programs of the Defense Minerals Exploration Administration and the Emergency Procurement Service; geologic investigations of mineral resources in Latin America, Asia, and Africa were made for the Foreign Operations Administration; a broad program of investigation of fissionable materials resources was continued for the Atomic Energy Commission; for the 13th consecutive year investigations of terrane conditions were made for the Armed Forces; and Survey geologists continued to serve as advisers and consultants to the National Science Foundation, the Office of Defense Mobilization, and the Department of Defense.

Mineral Deposits

Field work was conducted on 84 projects in 23 States; 11 of these projects were carried out in cooperation with state agencies. Exploratory drilling was continued on the Tintic, Utah, and Mojave Desert, Calif., projects, and on the Colorado Plateau. Regional mineral resource studies were completed for the New England-New York Inter-Agency Committee.

Systematic geologic mapping and detailed studies of active and potential mining districts were continued, to determine the geologic setting of the mineral deposits and the factors controlling their distribution and localization. An important element in the value of

Geological Survey's investigations of the occurrence of mineral deposits lies in the steady, long-term accumulation of geologic data. During the past year an ore-body was discovered in the Wisconsin lead-zinc district by a mining company on a geologic structure revealed by Geological Survey mapping. Diamond drilling near New Market, Tenn., based primarily on previous Survey mapping and geologic interpretation, has extended the limits of a major zinc deposit. Geologic maps of the Globe-Miami project, Arizona, show the presence of a well-defined mineral belt and have stimulated active prospecting in parts of the belt that are concealed by younger rocks. Intensive geologic studies on the Colorado Plateau continued, resulting in the finding of new uranium deposits of significant size and the extension of known reserves of other deposits. Detailed investigation of the distribution of chemical elements in sandstone-type uranium deposits has revealed a statistical relationship between the size of the uranium deposits and their content of certain chemical elements. This method has practical application in estimating the magnitude of an ore deposit on the basis of a relatively small exposure. In addition, a photogeologic mapping program was continued, designed to provide large-scale maps of the Colorado Plateau.

Petroleum and Natural Gas

The success of continuing exploration for oil and gas requires a constant increase in the geologic knowledge of the surface and subsurface. Many of the official reports of the Geological Survey make generally available the fundamental geologic information needed in areas of potential promise. An example of such a report is Professional Paper 259 published during the year describing the geology of the Berea sandstone in an area of about 47,000 square miles in eastern Kentucky, eastern Ohio, western Pennsylvania, southeastern Virginia, and western West Virginia. This paper is a study of the paleogeography and sedimentation of the Bedford and Berea formations; it will be useful in locating drill sites that can result in the discovery of new oil and gas fields.

During the year surface mapping was conducted in New York, Alabama, Mississippi, Maryland, Virginia, Texas, Kansas, Arkansas, Montana, Wyoming, New Mexico, Oregon, California, Washington, and Utah. Subsurface mapping was done in Florida, Ohio, Mississippi, Colorado, Kansas, Arkansas, Oklahoma, North Dakota, Montana, New Mexico, and California.

Coal

Studies were made of the coal resources of the Tennessee Valley, the Missouri River Basin, and other areas where steam coal is needed to

meet electric power requirements which can be only partly met by hydroelectric capacities. Coal is also being studied in older mining areas such as the Pennsylvania anthracite basins. Recent Survey investigations in the southern Anthracite field in Pennsylvania have shown that a thrust fault on the north side of the field has caused duplication of coal-bearing rocks and have directed attention to the possible presence of additional bodies of coal.

During the year summary coal resources studies were under way in Kentucky and Arkansas and completed in Alabama, Colorado, and Oklahoma. Field investigations were conducted in 12 States: Alabama, Tennessee, Kentucky, Ohio, Pennsylvania, Indiana, Arkansas, Colorado, Utah, New Mexico, Arizona, and Washington.

Oil Shale

In addition to field investigations and a core-drilling program on the oil-shale deposits of Naval Oil Shale Reserve No. 2, eastern Utah, study of the Tertiary geology and oil-shale resources of the Piceance Creek Basin between the Colorado and White Rivers, northwestern Colorado, was completed.

Engineering Geology

Engineering geology investigations of the Geological Survey are designed to provide basic geologic information for use in civil engineering works and other land-use programs. During the past year 25 field investigations were in operation in 11 States. Detailed engineering geology studies were in progress in the urban areas of San Francisco, Los Angeles, Seattle, Portland, Oregon, and Knoxville, Tenn. Geologic mapping continued in Massachusetts and Rhode Island under cooperative agreements with those States and manuscript reports were completed on two projects in the Missouri River Basin. General and specific research on landslide problems was continued at the Fort Randall reservoir, South Dakota, and in the Lake Roosevelt area, Washington. An engineering geology study along a part of the proposed Kansas Turnpike was made for the Kansas Highway Commission. In addition, foundation condition studies were made for the National Parks Service, and at Naval Ordnance installations.

General Geology

General geologic activities embrace studies in volcanology, metamorphism, tectonics, sedimentation, glaciology, surficial geology, and the geology of soils. Many of these studies are related to general

mapping projects in areas where potential mineral resources are as yet unknown.

Studies of terrain and volcano hazards in the Aleutians were completed for the Department of Defense. Stratigraphic work in parts of the phosphate fields of Florida was finished. Studies of the Glacier National Park were prepared for publication, and geologic work was completed in the Great Smokies of the Appalachians, the La Sal Mountains of Utah, and Carson Desert of Nevada.

Geologists at the Hawaiian Volcano Observatory, applying seismic and direct observations, became convinced last winter that an eruption in Hawaii was imminent. Late in February, a crack on the flank of Kilauea opened up and poured forth lava that threatened villages and overran plantations, destroying the most agricultural land in a Hawaiian eruption since 1868. However, by predicting the eruption and promptly recommending measures for evacuation and protection, the geologists prevented loss of life and minimized damage to property.

Geophysics

The program of development, testing, and modification of geophysical instruments and techniques was accelerated. A jeep-mounted scintillation logger, hand-portable scintillation logger, and a liquid scintillation core scanner were developed. Shallow seismic reflection equipment developed by the Survey during the previous year was further tested and refined; the method was notably successful in locating buried river channels in Ohio. Studies of radiowave frequency propagation, induced polarization, and electromagnetic methods were also undertaken. Regional geophysical studies in the Mojave Desert and in Salt Lake and Utah Valleys, using gravity and aeromagnetic methods, are yielding valuable information on the geologic structure. Regional studies are also underway on the Colorado Plateau, as part of an investigation of the occurrence of uranium, and in the Lake Superior region in an investigation of the occurrence of iron ore. Detailed precision gravity surveys were begun in the Camaguey District, Cuba, at the request of the Emergency Procurement Service, General Services Administration, in a program to increase known reserves of refractory chromite.

Studies of the physical properties of original-state cores from the Colorado Plateau indicate that the emplacement of uranium ore in at least two terrains is related to pore-water content and permeability, and that the usefulness of resistivity methods may therefore be broadened.

Studies of the radon content of well waters in Salt Lake Valley indicate that buried faults influence the concentration of radon and

that the trace of such faults may be defined by contouring the radon content of the well water.

About 70,000 traverse miles of airborne radioactivity and magnetic surveys were flown. Reconnaissance radioactivity surveys for radioactive raw materials were made in 9 States and significant results were obtained in several areas. Studies of radioactivity patterns associated with oil and gas fields and over various types of terrains and vegetative cover were begun.

Geochemistry and Petrology

Improvements continued to increase the efficiency and accuracy of analytical methods. Procedures were perfected to mechanize the screening and testing of radioactive samples submitted by the public. The rapid methods of rock analysis previously developed have been adopted in laboratories throughout the world; a revised and amplified manual of procedures has been prepared for publication. An automatic apparatus for making fluorescent tablets of samples for uranium determinations was invented, and has speeded this critical step tenfold. Spectrographic methods for various elements have been made more accurate and sensitive, and statistical methods are being applied to interlaboratory comparisons to improve the uniformity in results of spectrographic analyses. X-ray fluorescence methods have been brought to a high degree of development, by which they can be applied to the rapid nondestructive analysis of substances whose chemical behavior makes their analysis difficult by older procedures. An X-ray fluorescence instrument has been developed that will satisfactory quantitative analyses of very small grains of ore minerals, so that individual particles in thin and polished sections can be compared, and the tiny samples of powdered minerals in the spindles used for X-ray diffraction identification can also be analyzed for their elementary constituents. Field tests for geochemical exploration were further developed, and a mobile spectrographic laboratory was built and used for making rapid analyses at the sites of investigation.

Fundamental studies of geochemical processes were continued, with special emphasis on the occurrence of uranium and structure of uranium minerals. Study of uranium in carbonaceous materials such as coal and petroleum yielded information about the migration and concentration of uranium. Applications of nuclear physics to geological studies were widely exploited; radiochemical methods for determining the radioactive elements in rocks, minerals, and ores were developed; distribution of isotopes of copper, zinc, uranium, and lead were made which give information on mineral formation processes and the ages of formation. Mass-spectrographic studies of the isotopes

hydrogen and deuterium in natural waters have yielded information about the circulation of the atmosphere and the oceans, and about the water in glassy rocks. Radiocarbon age determinations have made possible the establishment of a reliable chronology of the Wisconsin glacial stage, have given absolute ages for dating many geologic events, for determining rates of sedimentation, erosion, and tectonic processes, and for measuring the addition of carbon dioxide to the atmosphere by recent coal combustion. The atomic pile at Oak Ridge National Laboratory was used for neutron bombardment of zircons to study their change with age, and for activation of natural copper samples to measure their isotopic ratios. Similar irradiation of coal samples was made at the Brookhaven National Laboratory, in studying the process of coal formation.

Fundamental research and development of methods for geochemical exploration work were continued, with field investigations in several mining districts and mineralized areas. Geobotanical exploration methods were investigated with particular stress on radioactive elements. The exploration methods have been made widely available by publication and by demonstration. Also they have been adopted by government and commercial organizations in several countries.

Paleontology and Stratigraphy

Many thousands of fossils from 35 States, Alaska, and 12 areas outside the continental United States were examined by specialists and the resulting information incorporated in 493 administrative reports for use in guiding the field work of other geologists and for eventual inclusion in publications by them on the geology and mineral resources of numerous areas.

Special research projects in support of strategic mineral studies such as the fissionable materials program, faunal studies of the subsurface rocks of the Williston Basin of the Dakotas and Montana, and studies of the Floridian-Bahamian carbonate province, as well as studies of a more general nature, were continued.

Work on the Jurassic, Triassic, Permian, and the Pennsylvanian paleotectonic maps is well advanced.

Geologic Investigations in Alaska

Survey efforts in Alaska continued to be directed toward the discovery and appraisal of the mineral resources of the Territory with emphasis on fuel resources for internal consumption and possible export and on strategic and critical minerals. Studies of engineering

problems and investigations of construction materials constituted an increasing part of the Alaskan work.

Petroleum investigations carried out northeast of Anchorage in the Nelchina area in fiscal year 1955 included the location of evidence of an extension eastward from the Nelchina area of Lower Cretaceous sediments under the adjacent Copper River Tertiary basin and the classification of the Cretaceous rocks of the Lower Yukon-Koyukuk area into 5 mappable units. Airborne magnetometer studies were initiated in southern Alaska to obtain information on sedimentary rocks in basins potentially favorable for oil. Results of field studies in the Gulf of Alaska Tertiary province and in northern Alaska (largely financed by Navy funds) were in the process of office compilation.

Coal investigations were again concentrated in the rail belt. Geologic mapping in the Nenana coalfield was completed and comprehensive reports on the results are in preparation. Subsurface exploration by power auger was carried out at 4 localities, 2 in the Little Susitna district of the Matanuska coalfield and 2 in the Homer district of the Kenai coalfield. In addition a brief examination was made of a coal occurrence on the Beluga River 50 miles west of Anchorage.

Other specific investigations included study of the locally mineralized Lituya Bay-Lynn Canal Transverse Belt of southeastern Alaska, of the promising southern Prince of Wales Island ferrous-base metal province, of tin and tungsten deposits on the Seward Peninsula, of reported occurrences of radioactive minerals in various parts of the Territory, and a reconnaissance study in the northeastern part of the Nutzotin Mountains. Field work in connection with reconnaissance geologic investigations in the Kuskokwim area was completed by means of cooperative arrangements with the 30th Topographic Battalion, United States Army Engineers. Cooperative investigations with the National Park Service were again carried on in the Katmai National Monument. Other activities included engineering geology studies of three potential power sites near Juneau, the routes of the proposed Denali and Browne-Nenana highways, several critical problems of the Alaska Railroad, and the completion of mapping in the greater Anchorage area.

Reconnaissance surveys for fissionable materials in various parts of the Territory were carried out, contributory to which a radiometric laboratory was maintained during the prospecting season at College, Alaska. Also in progress was compilation based on existing geologic information, and supplemented by photogeologic study on geologic quadrangle maps at a scale of 1:250,000 for more than 10 percent of the Territory.

There was a continued refinement of photogeologic techniques and an expansion of their application during the year. As a result of studies to date, and including those areas studied in connection with the Navy's exploration of Navy Petroleum Reserve No. 4, more than 100,000 square miles of Alaska have been mapped photogeologically. The geologic data contained in these maps are interpreted from aerial photographs and receive only limited field checking. Their primary functions are as bases for future geologic work and as interim geologic maps until more detailed studies can be made.

Military Geology

For the 13th consecutive year, geologic investigations on rock types, soils, vegetation, and water resources have been made by the Geological Survey to provide technical advice to the Corps of Engineers and other agencies of the Armed Forces. During the past year, 41 comprehensive studies of foreign regions and 32 special technical reports and maps were produced by a staff of geologists, botanists, soil scientists, and other technicians in the Washington offices. In addition, numerous advisory consultations, briefings, and lectures were provided to military technical and intelligence personnel on military aspects of the geology in foreign, Territorial, and domestic areas.

For the third consecutive year, technical assistance was provided to United States Army Engineers in Germany and Austria. Since November 1954, a team of specialists (geologists and soil scientists) has been assigned to headquarters in Heidelberg and Salzburg for the purpose of directing and instructing military technicians in the preparation of special-purpose terrain evaluation maps. A second team of specialists has been assigned to similar duties with the Engineers in Tokyo, Japan.

In December 1954, a geologist was assigned to accompany the Navy's Atka Expedition to the Antarctic. Special observations were made for evaluation of the engineering and construction properties, uses, and limitations of shelf and continental ice.

Field studies during the year were conducted largely in the western Pacific region and in Alaska. In the Pacific, a field survey was completed on Pagan and another brought to near completion on Truk. Further military geology reports on the Palaus, Okinawa, Saipan, Tinian, and Guam were brought to near completion and readiness for publication processing. Numerous engineering geology consultations were requested by the Far East Engineer Command, mainly in the evaluation and discovery of water resources for military uses in Japan, Korea, and lesser islands of the Pacific area. Increasingly numerous requests by the military, and a greater reliance on geologic advice in

engineering problems in the Pacific area, have been noted over the past few years.

A second large-scale field program, active since 1946, continued geologic and associated terrain condition studies in Arctic and Subarctic regions, particularly Alaska. During the fiscal year, field reconnaissance was conducted in three separate areas of the Copper River Basin, in the Cook Inlet area, at the Big Delta Military Reservation area, in the southwest Talkeetna Mountains, and on the north slope of the Brooks Range. Comprehensive military geologic reports are underway for these aforementioned areas and for previously investigated areas throughout Alaska. A military geology report on the Yukon Flats area was completed and submitted for publication during the next fiscal year. A special report on the geologic aspects of the Chena area was published. Close cooperation between the Alaska Road Commission and a Geological Survey party in the Copper River Basin area during the past year, has resulted in greatly increased knowledge of the limitations and special problems imposed by permafrost on road and other construction in Alaska.

In addition to studying and advising on specific problems in military geology as requested by the Corps of Engineers, the Survey also has furnished general guidance and instruction to military personnel in the preparation and use of military geologic reports and maps. About 20 officers and enlisted men of the Corps of Engineers were given a 2 weeks' training course in military geology preparatory to assignment to special engineer projects.

Foreign Geologic Investigations

The Geological Survey conducted investigations of mineral resources in Latin America, Asia, and Africa under the auspices of the Foreign Operations Administration, the Atomic Energy Commission, and the Emergency Procurement Service. Assistance in the appraisal of the mineral resources of Mexico, Brazil, Peru, India, and the Philippine Islands was continued. Similar programs were started in Cuba, Chile, Taiwan, Egypt, and Israel. Assistance programs were completed in Colombia, Ecuador, and Saudi Arabia and were nearing completion in Iran and Bolivia. Seminars were conducted in the United Kingdom and India to introduce the newest techniques of geochemical prospecting as a tool for use in the discovery of mineral deposits. A study of the engineering features of the geology of La Paz, Bolivia, is being used by the Government of Bolivia in overcoming construction hazards and in planning the future development of the capital city.

Geologic Maps

The Office of Geologic Cartography, in conjunction with the field units, prepared about 1,453 geologic maps, charts, diagrams, and other illustrations, many of them for multicolor reproduction. Final copy for 31 maps in the geologic quadrangle series, 31 mineral investigations maps, 44 fuels maps, 10 geophysics maps, and the geologic map of Alaska were transmitted to the Map Reproduction Branch. Ninety-seven other multicolor maps are in various stages of preparation.

Library

The Geological Survey Library again exceeded its records in circulation and reader activity. About 24,000 pieces were added to the collection, including 3,000 maps. A total of 48,224 items were loaned to Survey personnel for use outside the library, 4,803 books and maps were sent out on interlibrary loan and 3,553 items were borrowed from other libraries. An estimated 91,590 items were used within the library making a total circulation of more than 148,000. Nearly 27,000 reader visits were made to the library, 2,758 by non-Survey people.

Building up the collections in the branch libraries at Denver and Menlo Park continued with the acquisition of complete sets of important geologic, paleontologic, and general scientific serials as well as current material. Statistics on use are not complete, but the adequacy of the two libraries continues to improve.

The 1951 volume of the Bibliography of North American Geology was in page proof at the end of the year. The 1952-53 volume was completed in manuscript and sent to the editors and the cumulative volume for 1940-49 was in the final phase of preparation.

TOPOGRAPHIC DIVISION

Topographic mapping is an activity designed to furnish accurate and detailed information on the shape, position, and elevation of natural and manmade features of the earth's surface, to civil and military agencies of Government, and to the public. Under this activity, the Topographic Division is engaged in the preparation of an atlas of topographic maps covering the United States, its Territories and possessions, and in maintaining the usefulness of these maps through periodic revision. Certain related activities, such as control surveys, research, preparation of special maps, and supplying map information to the public, are also carried on by this Division.

Since it was established in 1879, the Geological Survey has published about 17,000 topographic maps, now covering about 73 percent of the area of the continental United States. However, many of the older maps, prepared under less stringent requirements, are of limited use today and subject to gradual replacement by modern maps. Others are in need of revision.

Because of better trained personnel and improved instruments and techniques, the Topographic Division showed substantial increase in map production and an appreciable decrease in unit costs in 1955. As a result, an additional 4 percent of the total area of the continental United States was mapped during the year, making a total of 37 percent of its area now covered with good quality maps.

During the year ending June 30, 1955, there were 2,266 maps transmitted to the Publications Office for printing and distribution. Of these maps, 1,280 represented new mapping by the Geological Survey, 121 were Geological Survey revisions of existing maps, 53 were new maps compiled by other agencies and, by interagency agreement, published and distributed by the Geological Survey, 115 were civil editions of maps which had been compiled previously and published for military use by the Department of Defense, 49 were one-color advance editions, 7 were planimetrics, 3 State base maps, 93 State index maps, and 4 were urban area maps. In addition 541 map reprints were transmitted.

The topographic mapping program continued in large degree to be directed toward national defense requirements. The mapping initiated in 1951 to satisfy the immediate and strategic requirements of the Department of Defense was further expanded in accordance with additional priority requests received from that Department. Preliminary plans have been made to accommodate anticipated priority mapping requirements of civil defense. Also, plans have been made for early initiation of mapping in areas pertinent to the implementation of Public Law No. 566, the Watershed Protection and Flood Prevention Act of 1954. Cooperative programs have been continued with many of the States. In addition some mapping has been performed in every State to satisfy civil requirements.

Technical assistance on topographic mapping, which was extended to other nations under the Mutual Security Act of 1951 as amended, was continued in 1955.

The Topographic Division assisted in preparing the mapping portions of the comprehensive resource development reports, prepared by the Arkansas-White-Red (AWRBIAC) and the New England-New York (NENYIAC) Interagency Committees. This work was substantially completed in 1955.

Permanent personnel was decreased this year from 1,896 man-years to 1,780 man-years, or approximately 6 percent. Despite this reduced

strength the output of the Division, measured in square miles of completed map compilation and revision, increased about 15 percent.

Mapping Programs and Map Production

Mapping or map revision was carried on during the year in all the 48 States, Alaska, Puerto Rico, the Virgin Islands and the Hawaiian Islands. Federal-State cooperative programs, whereby mapping costs are shared equally between the Federal Government and a State, county, or municipality, were conducted in the 29 States of Arizona, Arkansas, California, Colorado, Connecticut, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nevada, New York, North Dakota, Oklahoma (Tulsa County and city), Pennsylvania, Tennessee, Texas (city of Austin), Utah, Vermont, Virginia, Washington and Wisconsin, and in Puerto Rico. The Survey also continued to cooperate with the Tennessee Valley Authority in completing the topographic mapping of that valley.

The end of the year saw the substantial completion of a 5-year cooperative topographic mapping project in Kentucky. This is especially significant in that it represents the largest concentration of mapping operations on a single cooperative project, with the greatest overall accomplishment in the shortest period of time ever achieved by the Survey. This cooperative project resulted in covering the State, more than 40,000 square miles, with a series of 7½-minute maps at a scale of 1:24,000, or 2,000 feet per inch at a uniform scale. Of particular significance is the forward look of the Kentucky officials in immediately starting upon a program for map maintenance in revising those quadrangles in metropolitan areas that have undergone substantial development changes since the mapping was done, and making plans for periodic revision of all the quadrangles in the State.

In addition to the large continuing cooperative mapping program with the State of California, the Colorado River Boundary Commissions of California and Arizona have cooperated with the Geological Survey in the mapping of ten 7½-minute quadrangles along the river between the two States. This mapping was urgently needed in studying changes in the course of the river which originally marked the boundary.

During the year new priority mapping requests were received from the Department of Defense. One major request was for the dual coverage, at 1:25,000 and 1:50,000 scales of an area involving about 16,600 square miles, in Texas. Another major request was for a new 1:250,000 scale map series of all of Alaska, and the early completion of the large scale (1:63,360) compilation as basic data for a large portion of the Territory. The 1:250,000 scale maps when completed

will replace the provisional maps that were prepared at this scale a few years ago from existing incomplete source materials.

Mapping in the Territory of Hawaii was continued with the intent of publishing topographic maps of all the islands at the scale of 1:24,000. Operations during the year were conducted on the islands of Oahu, Molokai, Maui, and Hawaii. The mapping of Molokai was completed and the 5 quadrangle maps covering the island are now published. Of the 15 maps required to cover the island of Oahu, 4 have been published and the remaining 11 are nearing completion.

Mapping on the inch-to-the-mile (1:63,360) scale was in some stage of preparation on 471 Alaskan quadrangles covering about 87,000 square miles. Actual accomplishment, in terms of stereocompilation, was about 31,000 square miles. With 104 quadrangle maps published during the year, the total of published maps of this series is now 337.

Two editions of the popular Alaska Map E, scale 1:2,500,000 were published. A newly revised base and a shaded relief edition.

The 1:24,000 scale Virgin Islands mapping program was continued with the maps covering St. Thomas Island essentially completed. Aerial photography has been procured for St. John and St. Croix Islands.

The program of continuous map maintenance or revision in Puerto Rico was continued through cooperative agreement and under the supervision of a Topographic Division resident engineer.

Publication and distribution of a civil edition of the 1:250,000 scale maps of the United States were continued. Publication of the civil edition of these maps, compiled by the Department of Defense for military purposes, will provide topographic maps on the four miles-to-the-inch scale of many areas for which no topographic information of any kind has heretofore been available to the general public. One hundred and forty-two maps of this civilian edition have been published to date, including five covering the Hawaiian Islands.

To establish suitable ties between the detailed mapping operations and the fundamental geodetic surveys of the United States, the Geological Survey executed new third-order control surveys during the fiscal year, to the extent tabulated below:

Spirit leveling, 68,600 square miles.

Transit traverse, 46,900 square miles.

Triangulation, 41,400 square miles.

Permanent marks are established at intervals of 2 or 3 miles along the lines of leveling and traverse, and at most of the occupied triangulation stations.

During the year contracts were let for 183,683 square miles of precision aerial photography for topographic mapping purposes. Of this, 133,386 square miles was the more efficient twin low-oblique

photography. In addition, arrangements were made for the Air Force to furnish 58,384 square miles of photographic coverage to the Geologic Survey for use in making topographic maps of a number of Air Force bases. The Air Force also obtained approximately 60,000 square miles of photography in southern Alaska for mapping use by this Division.

One of the largest contracts for aerial photography was for coverage of the Brooks Range area in Alaska. The contract represents a pioneer venture in 1:250,000 scale mapping with transverse low-oblique photography of 121,800 square miles of rugged terrain.

Activities of the Special Maps Branch were in large degree a continuation of the preparation of charts for the USAF Aeronautical Chart and Information Center. In assisting the Air Force program of maintaining worldwide coverage of aeronautical charts, an important contribution is made to the overall Defense program. In addition, many special maps were prepared for other Divisions of the Geological Survey and for other agencies of the Federal Government; these maps included photogrammetric and cartographic map compilation, map revision, preparation of shaded relief, color separation drafting and photographic services. Among the 445 foreign charts completed during the year, 57 were entirely new photocompilation comprising about 160,000 square miles. Twenty-two new photocompiled special maps covered 63,000 square miles in the Arctic region. A large operation concerning radar was completed.

During the year, 110 shaded relief plates on foreign maps were completed. A 2-year program requiring the compilation and color separation drafting of domestic maps at the 1:1,000,000 scale for the United States Army Map Service was approximately 35 percent completed.

New mapping and map revision in the United States (excluding Alaska) for each of the major phases of mapping activity are as follows:

	New mapping (square miles)	Map revision (square miles)	Total (square square miles)
Photography.....			125,600
Horizontal control.....	88,300		88,300
Vertical control.....	68,600		68,600
Supplemental control.....	77,800		77,800
Stereocompilation.....	83,100		83,100
Field compilation.....	106,300	9,500	115,800
Drafting and scribing.....			104,000
Transmitted for reproduction.....			113,200

In addition, relief shading was completed for 16 quadrangles and for Alaska Map E.

The total opposite each operation in the foregoing tabulation represents approximately the annual accomplishments of the Division.

Variations in these totals are due to changes in backlogs and to work done on projects in which only certain operations were concerned. In the fiscal year, work was in progress on 6,784 quadrangles. It usually requires about 3½ years to survey a quadrangle and publish the resulting map.

A detailed summary of map production covering new mapping, re-mapping, and revision, is shown in the following table:

Areas (in square miles) mapped during fiscal year 1955 for publication on standard scales

[Contour intervals, 5 to 100 feet]

State	Area mapped, scale			New mapping	Revised mapping	Total
	1:24,000	1:31,680	1:62,500			
Alabama.....	62			62		62
Arizona.....	638		4,122	4,660	100	4,760
Arkansas.....	165			165		165
California.....	4,398		7,957	12,045	310	12,355
Colorado.....	3,068		297	3,365		3,365
Connecticut.....		640		2	638	640
Delaware.....	560			230	330	560
District of Columbia.....						
Florida.....	2,283			2,283		2,283
Georgia.....	803		535	1,338		1,338
Idaho.....	136		1,096	1,232		1,232
Illinois.....	56		651	704	3	707
Indiana.....	487			313	174	487
Iowa.....			446	446		446
Kansas.....	1,554			1,554		1,554
Kentucky.....	5,033			4,642	391	5,033
Louisiana.....	403		5,007	4,397	1,013	5,410
Maine.....			2,753	2,753		2,753
Maryland.....	159			36	123	159
Massachusetts.....		477			477	477
Michigan.....	176		2,246	2,422		2,422
Minnesota.....	677		1,766	2,443		2,443
Mississippi.....	36		2,296	2,174	158	2,332
Missouri.....	350		239	589		589
Montana.....	1,226		703	1,929		1,929
Nebraska.....	2,266			2,266		2,266
Nevada.....	45		379	424		424
New Hampshire.....	61		16	75	2	77
New Jersey.....	1,875			339	1,536	1,875
New Mexico.....	1,394		357	1,751		1,751
New York.....	3,110		2,662	5,156	616	5,772
North Carolina.....			777	777		777
North Dakota.....	988			988		988
Ohio.....	2,365			2,365		2,365
Oklahoma.....	183			183		183
Oregon.....	895		7,163	8,058		8,058
Pennsylvania.....	1,938		1,433	1,770	1,601	3,371
Rhode Island.....		479			479	479
South Carolina.....	220			220		220
South Dakota.....	2,300		152	2,452		2,452
Tennessee.....	1,338			1,338		1,338
Texas.....	2,685		5,384	7,166	903	8,069
Utah.....	1,381		7,564	8,888	57	8,945
Vermont.....	235		173	392	19	411
Virginia.....	350		882	1,096	136	1,232
Washington.....	565		1,716	2,220	61	2,281
West Virginia.....	241				241	241
Wisconsin.....	529		2,389	2,918		2,918
Wyoming.....	439		845	1,284		1,284
Total.....	47,676	1,596	62,006	101,910	9,368	111,278
Alaska.....			130,666	30,666		30,666
Hawaii.....	273			273		273
Puerto Rico.....		146			146	146
Virgin Islands.....	33			33		33
Total.....	47,982	1,742	92,672	132,882	9,514	142,396

¹ 1:63,360.

² 1:30,000.

Research and Development

A substantial amount of new photogrammetric equipment was put into production work during the year. This includes the ER-55 projector, the Twinplex plotter, aspheric-plate diapositive printers, and variable-ratio pantographs. Each new instrument was developed as part of an overall system for a more efficient way to compile maps photogrammetrically. A United States patent was issued on the Twinplex plotter, dated December 14, 1954, with all rights assigned to the Government.

A significant development during the year was the use of Government-owned T-12 cameras, equipped with near-distortion-free lenses, on certain of our commercial contracts. Photography procured with these instruments is proving to be superior to any heretofore obtained with other aerial cameras.

A new system of checking contractors' cameras before using them on Division projects was instituted during the year. Cameras are now precisely tested on a multicollimator camera calibrator which was designed and built to meet specific Topographic Division needs. Metric characteristics, resolution quality, and mechanical operations are readily evaluated in order to determine if a camera is completely acceptable prior to use.

Design work for a new instrument, the Orthophotoscope, is nearing completion. This is a device for converting conventional perspective photographs to the equivalent of orthographic photographs.

A contract has been placed for twin-camera mounts, the design of which is based on a center-of-gravity principle, to eliminate the effects of airplane vibrations and other motions.

Extensive field tests of our first Survey-developed pendulum alidades continue to show savings in time with improved accuracy. Conversion of our present alidades to the pendulum type is under way.

Multiple base altimetry studies and tests have been made to take into account the slope of the barometric equal pressure surface and to improve instrumental accuracy. The results indicate altimetry is capable of wide application in obtaining elevations for photogrammetric needs in areas of both moderate and high relief.

Integration of negative engraving, or scribing, to replace the drafting process in map-finishing operations, has proceeded so that conversion of all the Division's drafting offices to the negative scribing process is essentially complete.

Continuing progress in writing the Topographic Manual resulted in 27 new chapters, bringing the total published to 69. There are 45 chapters in various stages of preparation and it is estimated that the project is about 75 percent complete.

Work continued on the preparation of contour interval plans for each of the 48 States. Eighteen have now been completed and 13 others are in progress.

Map Information Office

The Map Information Office continues its service to Federal, State, and local Government agencies, and the general public. Requests for maps, geodetic control data, and aerial photographs, continued to increase.

With the current quarterly practice of issuing maps showing the status of mapping in progress, the demand for advance map material has increased over that of previous years.

Heavy demand continues for geodetic control data. Two thousand, one hundred orders were serviced during the year amounting to about 18,900 copies of horizontal and vertical control data assembled in 15-minute quadrangle units.

Aerial photography sales from approximately 2,600 orders resulted in some 121,000 reproductions furnished.

Nearly 13,000 letters were answered by the Office during the year. In addition, 5,160 requests for indexes and status maps were serviced.

WATER RESOURCES DIVISION

The work of the Water Resources Division is to determine and appraise the Nation's surface and underground water resources. During fiscal year 1955 there was a further increase in the public interest in water-resource investigations, due in part to local and regional floods or droughts, in part to increasing competition for existing supplies by municipalities, agriculture, and industry, and in part to a broadened awareness of the importance of having adequate hydrologic data on hand prior to design and construction of such structures as municipal waterworks, reservoirs, dams, and bridges.

Water-resources investigations include the systematic collection, analysis, and publication of hydrologic and related geologic data; appraisal of water resources of specific areas; determination of water requirements for industrial, domestic, and agricultural uses; and research and development to improve the scientific basis of investigations and techniques.

Water-resources investigations are financed from directly appropriated funds, funds transferred from other Federal agencies for work performed directly for them, and from funds provided by States and municipalities for cooperative investigations. From the beginning of Federal-State investigations in 1895, the "partnership" arrange-

ment has grown to include work in all 48 States and in Hawaii and Guam, and to become the largest part of the Division's program each year. Funds made available by States and municipalities in 1955 for cooperative studies were:

<i>State</i>	<i>Obligation</i>	<i>State</i>	<i>Obligation</i>
Alabama	\$91,733	New Hampshire.....	\$16,795
Arizona	102,937	New Jersey.....	72,375
Arkansas.....	52,782	New Mexico.....	141,136
California.....	320,317	New York.....	206,475
Colorado	72,972	North Carolina.....	105,961
Connecticut	22,426	North Dakota.....	42,297
Delaware.....	36,741	Ohio	140,685
Florida.....	156,848	Oklahoma	76,754
Georgia	62,633	Oregon.....	64,901
Idaho.....	61,513	Pennsylvania.....	134,320
Illinois.....	55,761	Rhode Island.....	20,964
Indiana	113,594	South Carolina.....	34,257
Iowa.....	92,979	South Dakota.....	10,019
Kansas.....	63,799	Tennessee	82,478
Kentucky.....	144,625	Texas.....	268,840
Louisiana.....	130,570	Utah.....	112,000
Maine.....	10,826	Vermont	8,273
Maryland	64,734	Virginia.....	83,819
Massachusetts	42,093	Washington	131,074
Michigan.....	78,809	West Virginia.....	36,450
Minnesota	94,987	Wisconsin.....	43,486
Mississippi	45,030	Wyoming.....	55,129
Missouri.....	28,502	Guam.....	16,659
Montana.....	35,794	Hawaii.....	83,777
Nebraska.....	73,241		
Nevada.....	31,624	Total.....	4,076,797

Surface-Water Investigations

The measurement and publication of basic information on streams, lakes, and reservoirs was continued on a comprehensive scale, with special emphasis given to timely and useful presentation of data collected. These records provide a sound foundation of facts for use in subsequent analysis and study of a wide variety of hydrologic and engineering problems.

Records of surface-water supplies were obtained at more than 6,800 sites in the 48 States and in Alaska, Hawaii, and Guam during fiscal year 1955. Included among the records of surface-water supply are 4,400 records collected in cooperation with 187 agencies of States or their subdivisions and 1,700 records obtained for other Federal agencies such as the Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, State Department, Soil Conservation Service, Atomic Energy Commission, and permittees and licensees of the Federal Power Commission.

The compilation of all streamflow records in the United States, for the period 1888-1950, is now 57 percent complete. During the year, completed compilation volumes were published for the New England basins and the Colorado River Basin. These summary streamflow reports will enable water-supply and sanitary engineers, designers and operators of flood-control systems, irrigation projects, and power plants, as well as many others concerned with historical and long-term streamflow data, to have monthly and annual discharge figures and other data in one volume instead of nearly 50 separate reports in the annual water-supply paper series.

Special reports on floods were in progress or near completion for 17 States. Flood-frequency reports for three States prepared by the Geological Survey in cooperation with State agencies, were published during the year. Flood-frequency studies were completed in three other States, and reports are in process of publication. A start was made on a nationwide flood-frequency study that will provide a means for deriving flood frequencies on all streams in the United States.

Hydraulic data on 96 sites where bridges are to be built were furnished to various highway departments during the year, and the number of cooperative agreements with State highway departments was increased to 25. The program of collecting flood-flow data on small streams by means of crest-stage and continuous gages, useful in the design of culverts, is being augmented.

Seventeen interstate compacts for apportionment and division of interstate waters are now in effect and two are under negotiation. These compacts include provisions for measurement of available water, usually by the Geological Survey.

During the year the Chief Hydraulic Engineer of the Geological Survey was appointed by the United States Supreme Court to serve as river master for the Delaware River. As such he administers the terms of the court decree relating to the diversion of water from the Delaware River to supply New York City and to the release of water to improve the low flow of the Delaware River.

Water-resources investigations were made along the Canadian boundary as required by the Boundary Waters Treaty of January 11, 1909, between the United States and Canada, or by orders issued by the International Joint Commission.

Ground-Water Investigations

During 1955 notable progress was made on the more than 500 ground-water projects that are currently under investigation throughout the Nation. These investigations embrace one or more of the following principal types of activity: (1) Describing the occurrence,

quantity, and quality of ground-water resources, including delineation of ground-water reservoirs and opportunities for their recharge; (2) describing the occurrence and quality of inland sources of saline waters of interest in any future program of saline-water conversion; (3) studying in detail the hydrology of mining- and oil-field areas, as an aid to both location and economical development of these resources; (4) determining the loss of water through consumption by water-loving nonbeneficial vegetation, as a preliminary to salvaging a part of the water; and (5) describing the nature and extent of salt-water encroachment in coastal areas, as a guide to combating its effects. Most of the projects were a part of cooperative programs with State and municipal agencies in more than 40 States with Hawaii and Guam, and with a number of other Federal agencies, including the Armed Forces, the State Department, the Department of Agriculture, the Atomic Energy Commission, and companion bureaus of the Department of the Interior.

The investigational reports released to the public during the year included descriptions of ground-water occurrence ranging from those found in areas of water scarcity to those in areas of water abundance. Areas of potentially greater use of ground water were described in reports on certain parts of Colorado, Delaware, Maryland, Minnesota, Montana, Nebraska, Nevada, New York, North Dakota, Ohio, Oklahoma, Rhode Island, Texas, Virginia, and Wyoming. Other parts of some of these same States have problems of inadequate water, especially in local areas of heavy pumping.

One of the most significant ground-water studies recently completed concerns that part of the Minidoka project in Idaho known as the North Side pumping division. This is the first major Federal reclamation development in the United States based on ground water. The large perennial supply of ground water contained in the basalt beneath the Snake River Plain will permit irrigation of about 64,000 acres of the project. The reclamation project was authorized by Congress on the basis of a preliminary report by the Bureau of Reclamation. Thereafter, on behalf of that Bureau, the Geological Survey provided additional information on the occurrence and movement of ground water, making the results available in a report released recently.

During the year an important series of areal geologic maps was issued in preliminary form. They were prepared in connection with the Bureau of Indian Affairs, and cover most of the 20,000-square-mile area of the Navajo and Hopi Indian Reservations in Arizona and Utah and a part of that in New Mexico. The series released to date consists of 89 15-minute quadrangles showing roads, settlements, drainage, contacts between geologic formations, the dip of the formations,

and the trace of the principal geologic structures. The primary use of the maps will be in the development of water supplies from wells, but supplementary use will be made by geologists, engineers, and prospectors in locating mineral and fuel deposits.

The results of two cooperative studies were published as part of an atlas series. Atlas No. 4, prepared in cooperation with the Conservation and Survey Division of the University of Nebraska, shows the configuration of the water table throughout the State. Used in conjunction with topographic and geologic information, the map will aid in locating water supplies and will be of special help to full development of Nebraska's water resources. Atlas No. 5, prepared in cooperation with the Agricultural and Industrial Development Board of Kentucky, is a map of the Louisville area, Kentucky, showing contours on the bedrock surface. The bedrock surface shown on the map defines the lower limit of the alluvial gravel and sand deposits tapped by most of the wells in the area.

Chemical-Quality Investigations

The object of the Survey's chemical-quality investigations is to determine the quantity, type, source, and distribution of mineral matter in solution in ground and surface waters as a prerequisite to the selection and development of industrial, municipal, and agricultural water supplies. During 1955 much progress was made toward this objective as a result of a wide variety of projects, some nationwide in scope, others related to problems characteristic of regions or local areas.

During the year the chemical quality of about 64,000 samples of water from streams, lakes, springs, and wells, was determined. The major proportion of these water samples was collected at about 450 daily or periodic key sampling sites, mostly on streams, while about 9,000 analyses were of water from wells and springs.

The program included chemical-quality studies of the streams in the Colorado River, Pecos River, and Columbia River Basins, in the New York-New England States, and in Alaska. Also, a network of sampling stations was maintained on western streams to determine trends in mineral content and thus help to insure successful continued operation of irrigation projects. Chemical-quality studies of surface and ground waters were conducted in cooperation with State and municipal agencies in 16 States. Chemical-quality work was also done for the Department of Defense, Atomic Energy Commission, Bureau of Reclamation, Veterans Administration, Federal Housing Authority, and Public Health Service.

Several reports of major importance were released during the 1955 fiscal year. One of these is a reference report consisting of a 2-volume

compilation of chemical analyses of water from 1,315 of the larger cities of the United States and is entitled, "Industrial utility of public water supplies in the United States, 1952." The report supersedes a similar report published in 1932. Each volume contains explanatory and interpretive introductory material, including a statistical treatment of the data and map description of hardness of waters in the United States.

In 1955 the first report in a new annual series was published. The series will provide comprehensive continuing information about the chemical quality of surface waters used for irrigation in western United States. The continuous long-term records will assist in the determination of quality of water prior to irrigation development, the extent of water-quality impairment due to drainage return, requirements for maintaining proper salt balance, and the equitable distribution of water.

Publications of special interest included a 4-year progress report on water in the lower Delaware River of New Jersey, Pennsylvania, and Delaware, and reports describing the surface waters of North Carolina, Oklahoma, and Texas, prepared in cooperation with the respective States.

Water temperature measurements are made as a regular part of all chemical-quality investigations. Temperature variations in time and place are of importance to waterworks, industry, fish culture, sediment-transport studies, etc. Daily observations or continuous recordings of temperature were obtained during 1955 at approximately 390 locations. Measurements at many additional locations were made at weekly or monthly intervals.

Sediment Investigations

The investigation of sediment in streams and rivers was continued during 1955, including sampling at 158 sediment stations. Sediment in variable amounts is transported in all natural streams, and the proper design and operation of water development projects must satisfactorily accommodate this sediment.

Comprehensive sediment programs were continued in the Missouri, Rio Grande, and Colorado River Basins. These programs provided measurements and interpretations of sources of sediment, rates of discharge, and other pertinent facts at selected areas and locations to guide the extensive Federal programs of water development in these areas. Assistance to the program of the Soil Conservation Service was provided by projects in small watersheds in the States of North Carolina, West Virginia, Kentucky, Nebraska, Oklahoma, and Texas.

Cooperative programs in sedimentation continued in Iowa, Wisconsin, Kentucky, Ohio, Pennsylvania, and Virginia. Included were intensive investigations of several small watersheds in Pennsylvania and Wisconsin designed to measure and explain changes in the runoff and sediment discharge resulting from the application of conservation practices.

Several reports of investigations were prepared and released to open file. The report, *Computation of Total Sediment Discharge, Niobrara River, Near Cody, Nebraska*, presents improved and simplified methods for computing the total sediment discharge of streams. Another report, *Upland Gully Erosion In the Dry Creek Basin, Nebraska*, analyzes sediment sources and erosion processes typical of such areas.

Joint Projects

A few major projects combine two or more types of investigations. Examples of projects of this type on which progress was made in 1955 include studies of water resources in industrial production centers; an inventory of saline water resources; and a survey of the natural radio-activity of surface and underground waters in the United States. In 1953, the Business and Defense Services Administration requested an expanded series of summary reports on the overall water-resources situation for a number of critical centers of industrial production in the Nation. Manuscripts were prepared or reports published on the following industrial areas during the 1955 fiscal year: Wheeling, W. Va.; Steubenville, Ohio; Indianapolis, Ind.; Portland, Oreg.; San Francisco, Calif.; and Mobile, Ala. A report for official use was also submitted within the past year on the water requirements of the pulp and paper industry, a very large water user. A report on rayon and acetate fiber is nearing completion and studies have been started for copper and petroleum products.

During 1955 notable progress was made on the inventory of the occurrence and quality of saline water resources of the United States. A nationwide reconnaissance study was completed, a more extensive study of saline waters in Texas was completed, and a study of saline waters of North Dakota neared completion.

With the increasing amounts of radioactive wastes and potential radioactive contamination of our waters, data on background ("natural") amounts of radioactivity in stream and well waters is necessary in order to measure accurately any increases in contamination when they occur. Research on techniques and interpretation continued in 1955 while a limited program of systematic radiometric sampling of our natural waters was also in progress.

Research and Development

Research and development projects included a study of the factors involved in artificial recharge of ground water; design and development of water-well geophysical exploration units and electrical-analog analyzers; studies of aggradation and degradation in alluvial channels; study of principles of sediment transport; investigation of improved methods and equipment for determining total sediment discharge of streams; basic research in the determination of radioactivity in natural water supplies; a study of the backwater effects of channel constrictions; the hydraulic principles governing the distribution of river flow in multiple-opening river crossings; a study of hydraulic principles governing the flow of water through culverts; studies of new techniques for measuring losses of water from reservoir and land surfaces; and development of means for rapid computation of streamflow records.

Soil and Moisture Conservation

The Geological Survey's program of soil and moisture conservation provided basic data and advice concerning hydrologic and geologic problems for the improvement and maintenance of the productive values of the 280 million acres of Federal land under the stewardship of the Department of the Interior. Special attention was given to comprehensive investigations of water supplies to cover entire grazing or Indian districts so that future "crisis" demands for water in the region could be met efficiently and promptly. Elements of the program were carried on in 1955 on public domain areas of Arizona, Colorado, Montana, New Mexico, Nevada, South Dakota, Utah, and Wyoming.

Technical Assistance Program

The overseas water-resources investigations of the Geological Survey began in 1950 on a continuing basis under the terms of the United States technical assistance program, and during 1955 were conducted under agreements between the Geological Survey and the Foreign Operations Administration. The investigations were initiated by requests from the various countries to the United States overseas missions for technical assistance.

Long-term projects were being carried on in 9 countries by the end of the fiscal year. Of these projects 7 were directed primarily toward ground-water investigations and 2 toward surface-water investigations. Additional short-term ground-water projects were conducted in Thailand and Anglo-Egyptian Sudan and a short-term project on

flood-control basic data was conducted in India. The projects generally are designed to combine the training of a nucleus of native personnel in the methods and techniques of water-resources investigations with investigations of specific areas for which development has been proposed. At the end of the year more than 100 nationals were receiving in-country training by Survey personnel on field projects in Afghanistan, Chile, Egypt, India, Iran, Libya, Pakistan, and Peru. One field project in stream-gaging was completed in Jamaica in cooperation with the United Nations and under the auspices of the Technical Assistance Administration. During the year citizens of Canada, Colombia, Cuba, Egypt, and Thailand received training in the United States.

CONSERVATION DIVISION

The Conservation Division classifies Federal lands as to mineral and water resources and supervises mineral-recovery operations under leases, permits, and licenses on Federal, outer Continental Shelf, Indian, and naval petroleum reserve lands. A small headquarters staff and a field staff of competent geologists and engineers are maintained. This force makes field surveys, prepares maps and reports dealing with waterpower, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts on-site supervision of mining and drilling operations necessary to assure the safe and economical production by private enterprise of coal, oil, gas, and other minerals.

Mineral Classification Branch

All phases of the service rendered by the Mineral Classification Branch were maintained at a rapid pace throughout the fiscal year 1955. In all, 24,137 cases involving either the outright disposal of Federal lands with no reservation of any mineral, the disposal of such lands with the reservation of one or more specified minerals, or the exercise under the Federal leasing laws of the Government's right to lease for exploration and production, by private enterprise, one or another mineral substance from lands under its jurisdiction, were acted upon during the year. In addition, the Branch prepared and promulgated initial or revised definitions of the known geologic structure of 46 producing oil and gas fields containing Federal lands; appraised geologically 163 unit-plan and participating-area proposals; drafted 12 determinations of leasehold relations to the productive limits of producing oil and gas deposits as found to exist on August 8, 1946; reported for appropriate administrative action the fact and geologic significance of 86 new discoveries of oil or gas made on or affecting

Federal-land leaseholds; recommended the competitive sale of oil and gas leases on 26 parcels of public land; reviewed and reported upon 37 appeals from decisions of the Bureau of Land Management affecting the disposal of Federal lands; and prepared 93 miscellaneous reports on the mineral potentialities of specific lands for various agencies of the Federal Government and inquiring individuals.

From field offices in Colorado, California, Montana, New Mexico, Oklahoma, Utah, and Wyoming, geologists from the Branch made "demand" or specific investigations which resulted in geologic reports and maps for official use. The Branch completed maps and reports on the Belgian Anticline and Mount Poso areas in California; on dam sites on the Cispus River, Wash.; on the Grand Bay oilfield and Houma gasfield in Louisiana; on the Bowes field, Montana; on the Malaga field in New Mexico; on the Tisdale Anticline, Wyoming; on the Yates formation, New Mexico; on dam sites on Byoff and Wagon Creeks and North Fork of Yuba River in California; on the Dry Creek oilfield, Montana; on the Lompoc and Cat Canyon fields, California; on Montana Plains; on the Placerita and Holder Canyon fields, California; Greenwood gasfield, Colorado and Kansas; on Colorado Plains; on Williams Fork Mountain coalfield, Colorado; on the Monument-Jal and San Juan fields, New Mexico; on coal near Weaver-ville, Calif.; on a portion of the Huntington Beach field, California; on mineral resources, State of Washington; on the Northwest Belgian Anticline, California; on Hamilton Dome field, Wyoming.

Water and Power Branch

The Water and Power Branch conducts investigations to determine potential waterpower possibilities; classifies public lands having value for development of waterpower projects; and works closely with other bureaus and agencies in administration of the public lands so classified. These duties are carried out from a central and regional office in Washington, D. C., and from regional offices in Denver, Colo.; Sacramento, Calif.; Portland, Oreg.; and Tacoma, Wash. Investigatory work in Alaska is directed from Tacoma, Wash. Field work during 1955 was directed mainly toward obtaining basic information on the waterpower resources and storage possibilities of Federal lands in Alaska, California, Colorado, Montana, New Mexico, Oregon, and Washington. Field projects during the year included surveys on Bradley, Chickaloon, Kasilof, and Kenai Rivers, Alaska; Klamath and North Yuba Rivers, Calif.; Arkansas River, Colo.; Flathead and Yaak Rivers, Mont.; Navajo River, New Mex.; Imnaha, Klamath, Nestucca, Trask, and Wilson Rivers, Oreg.; and Callagan and Isabel Lakes, South Fork Skykomish, and Wynoochee Rivers, Wash. In all,

242 channel miles of stream and 13 dam sites were mapped during the year or were under investigation on June 30, 1955. Maps published during the year covered 230 channel miles of stream and 5 dam sites; maps awaiting publication on June 30 include 61 channel miles of stream and 4 dam sites; maps in the office stage of preparation on June 30 include 364 channel miles of stream and 5 dam sites. One report was published as a circular during the year and eight reports were in preparation for publication on June 30. They include an appraisal of waterpower possibilities of streams in Alaska, California, Colorado, Nevada, New Mexico, Oregon, and Washington and a general survey of developed and potential waterpower of the world. Classification activities resulted in the addition of 7,249 acres to power site reserves and elimination of 67,059 acres, reducing the outstanding reserves in 23 States and Alaska to a net total of 7,103,749 acres. Reservoir site reserves were reduced to 135,263 acres by elimination of 629 acres. Supervision was given to 134 power projects under license upon request from the Federal Power Commission and to 827 such projects under permit or grant from the Department of Interior, and to 204 in cooperation with the Bureau of Indian Affairs. Action involving hydraulic determination was taken on 6,338 cases received from departmental sources and the Federal Power Commission.

Mining Branch

The Mining Branch supervises operations concerned with discovery, development, and production of coal, potassium, sodium, phosphate, and oil shale from public domain lands; of sulfur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals, except oil and gas, on restricted allotted and tribal Indian lands, on "acquired lands" under the act of August 7, 1947, and provisions of section 402 of the President's Reorganization Plan No. III of 1946, on land in the California State Park under the act of March 3, 1933 (47 Stat. 1487), and on national forest land in Minnesota under the act of June 30, 1950 (64 Stat. 311).

Outstanding mineral leases and permits on "acquired" and Indian lands and lands subject to the aforementioned acts involve the exploration for and production of bauxite, cobalt, copper, gold, iron, lead, manganese, silver, nickel, titanium, tungsten, uranium, vanadium, zinc, asbestos, bentonite, clay, coal, garnet, gravel, gypsum, feldspar, fluor-spar, limestone, marble, mica, phosphate, pumice, quartzite, quartz crystal, sand, silica sand, sulphur, and vermiculite.

The Branch is responsible for investigating and reporting on applications for leases and prospecting permits; recommending lease terms, enforcing compliance with lease terms and of regulations governing the conduct of prospecting, mining, and beneficiation, protecting and conserving the natural resources by preventing waste; determining royalty liability; preparing statements and receiving payment of royalties and rentals. The Branch acts in an advisory capacity to the Office of the Secretary, other bureaus of the Department, and other Government agencies.

As of June 30, 1955, there were under supervision 1,813 properties involved in leases, permits, and licenses in 32 States and Alaska, of which 992 were on public lands; 226 on acquired lands; and 595 on Indian lands. Production from such lands under supervision during the fiscal year amounted to 18,845,648 tons, valued at \$126,640,569, with royalties amounting to \$5,439,344. The production of coal from Federal land in the United States and Alaska aggregated 5,822,237 tons, valued at \$31,458,869 with a royalty value of \$739,455. Production of coal in Alaska amounted to 689,386 tons. Potash production amounted to 8,602,953 tons of crude and refined salts valued at \$58,098,292 and royalty value of \$2,453,676 during the fiscal year.

The principal source of sodium was Searles Lake, Calif., accounting for 619,329 tons of the total of 765,939 tons of sodium and associated compounds produced from lands under supervision. Total and royalty values of sodium were \$19,322,121 and \$616,851, respectively. Phosphate rock and shale production was 1,162,091 tons—548,097 tons from public domain; 3,390 from acquired lands; and 610,604 tons from Indian lands.

Production of lead and zinc concentrates from Indian lands amounted to 35,536 tons valued at \$4,037,633 and royalty value of \$322,889. Coal and sand and gravel made up the major part of the remainder of the production from Indian lands totaling 1,849,393 tons valued at \$1,636,310 and royalty value of \$64,387. Coal, fluorspar, zinc, asbestos, bentonite, phosphate, mica, quartzite, feldspar, manganese, quartz crystal, stone, and sand and gravel were produced from acquired lands in 13 States to an aggregate of 295,925 tons valued at \$2,081,851 and royalty value of \$97,906.

Oil and Gas Leasing Branch

The Oil and Gas Leasing Branch supervises operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas on Federal and Indian lands. These duties were carried out during the year by means of 6 regional

offices and 21 district offices at 21 separate locations in California, Colorado, Louisiana, Montana, New Mexico, Oklahoma, Utah, Wyoming, and Washington, D. C. On the public lands 95,890 oil and gas properties were under supervision at the end of the fiscal year, aggregating 71,686,124 acres in 23 States and Alaska.

Drilling on public lands during the year included the spudding of 1,413 wells and the completion of 1,352 wells, of which 937 were productive of oil or gas. In all, 21,758 wells, including 12,433 capable of oil or gas production, were under supervision on June 30, 1955. Production was appreciably greater than in 1954, amounting to about 110,595,718 barrels of petroleum; 260,661,003,000 cubic feet of natural gas; and 211,127,968 gallons of gasoline and butane, with royalty returns to the United States of about \$39,222,638.

There were 3,176 acquired land leases, embracing 3,007,824 acres in 29 States under supervision at the close of the fiscal year. Drilling on acquired lands during the year included the spudding of 49 wells and the completion of 49 wells, 21 of which were productive of oil or gas. In all 534 acquired land wells, including 239 capable of oil or gas production, were under supervision on June 30. Including compensatory royalty allocated to the Rio Vista gasfield the production from acquired land was about 2,862,960 barrels of petroleum; 7,432,954,000 cubic feet of natural gas; and 57,410 gallons of gasoline and butane, with royalty returns of about \$1,268,203.

The Branch supervised operations on 10,900 leaseholds, embracing 3,117,176 acres on Indian lands in 16 States, which contained at the end of the year a total of 8,353 wells, 4,657 of which were productive of oil or gas, and 488 of which had been completed in the year. The total revenue from royalties, rentals, and bonuses amounted to \$19,044,522. Of this amount, \$5,958,121 accrued as production royalties.

Outstanding on June 30, were 12 protective leases issued to protect from drainage Federal lands subject to leasing (national monuments, military reservations, etc.). A total of 45 productive wells on these leases returned royalty for the year in excess of \$829,294. On behalf of the Department of the Navy, supervision was continued over the production of oil, gas, gasoline, and butane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 299 active wells in this reserve totaled 2,206,989 barrels of petroleum; 1,689,539,000 cubic feet of natural gas; and 9,627,897 gallons of natural gasoline and butane, with an aggregate royalty of \$959,177.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 72 new unit plans during the year and the termination of 70 previously approved unit plans, leaving 303 approved plans, covering 5,333,097 acres, outstand-

ing. About 50 percent of the petroleum, 26 percent of the natural gas, and 61 percent of the gasoline and butane obtained from public lands during the year was produced under approved unit agreements. One Indian land unit agreement was terminated during the year and one was contracted, leaving a total of 11 such approved plans, covering 58,580 acres, outstanding on June 30. Also, 96 drilling unit, or communitization, agreements were approved during the year, making a total of 482 approved as of June 30.

Work on Publications

The primary purpose of the Geological Survey is to provide for the people and the agencies of government information necessary for the exploration, development, and conservation of our mineral and water resources. As this information becomes available through investigations, surveys, and research, the fulfillment of this purpose is served by the publication of a variety of reports, maps, and charts. The information is published in part by the Survey and, in part, by cooperating States, and by many scientific journals. These publications include maps of the topographic and geologic features of the Nation, studies of mining districts and mineral deposits, of the composition and structure of rocks and minerals, of fossils and the rocks in which they are found, of geophysics and geochemistry, and studies of stream-flow and ground waters and their chemical quality.

Section of Texts

Editing and otherwise preparing Survey-produced manuscripts for publication is the function of the Section of Texts. It performs practically all liaison duties necessary to the printing of Survey professional papers, bulletins, water-supply papers, and circulars.

During fiscal year 1955, 234 new manuscripts were received by the Section, 205 were sent to the printer and 237 reports were published. Work on new manuscripts prepared in fiscal 1955 included editing of 21,941 pages; checking of 3,647 galley proofs and 12,506 page proofs; preparing 26,192 index entries and readying 94 pages of miscellaneous material for mimeographing.

Printed reports delivered included 46 professional papers, 47 bulletins, 60 water-supply papers, 35 circulars, and 30 chapters for the new edition of the Topographic Manual. These publications covered a wide range of subject material: General geology of particular areas; mining districts and local mineral deposits in the United States, Alaska, Hawaii, Mexico, and the Marshall Islands; studies of fossils; a collection of papers on geochemical research; geophysical abstracts,

measurements of streamflow and of water levels and artesian pressures in wells; general studies of underground water and of the occurrence of floods with consideration of the influence of geology and physiography.

Lists published monthly provided information on new publications of the Survey. Also printed during the year was the First Supplement to Publications of the Geological Survey. Copy for the Second Supplement was prepared and sent to the printer.

Section of Illustrations

This Section prepares illustrated matter used in publications of the Geological Survey.

At the beginning of the fiscal year, 61 reports were on hand, 55 of which were in various stages of completion; 139 new reports were received during the year, making a total of 200 reports. Of this total, 92 were completed and transmitted for publication, as compared to 85 in fiscal year 1954. At the end of the year, 108 reports were on hand, 66 of which were in various stages of completion.

The reports transmitted included 42 bulletins, 21 professional papers, 26 water-supply papers, and 3 hydrologic atlases; 1,935 drawings and photographs were prepared for these reports. A total of 246 maps, sketches, and diagrams were also prepared for 28 circulars.

During the year, 115 miscellaneous drawings and preliminary work on 96 geologic quadrangles of the Navajo Indian Reservation were completed for the Water Resources Division.

A total of 2,392 drawings and photographs were completed by the Section, of which 225 were for multicolor reproduction.

Map Reproduction and Distribution

The warehousing and distribution of Geological Survey maps are handled primarily by the Washington, Denver and Alaska sections of the Distribution Branch. Local distribution is also carried on by 12 other Survey field offices and more than 400 commercial agents who purchase maps for resale to the general public.

In addition to approximately 25 million maps and book reports on hand at the beginning of the year, the branch received 7,300,000 copies of 2,669 new and reprinted maps from the Map Reproduction Branch and 224,750 copies of 321 separate books and pamphlets printed by the Government Printing Office and the Interior Duplicating Section.

Approximately 3,210,000 maps and indexes were distributed during the year and about 290,000 volumes were involved in the limited distribution of book reports. This distribution activity represented an

increase of 34 percent over the previous year and was accomplished at a slightly reduced cost. This record breaking distribution has resulted from the processing of more than 200,000 individual requests and resulted in receipt of \$370,000 from the sale of maps, \$24,000 of which was received from other Federal agencies.

The total number of copies of maps and book reports distributed by the Geological Survey offices as compared with fiscal year 1954 is shown in the following table:

	Fiscal year 1954 maps, reports, and indexes	Fiscal year 1955 maps, reports, and indexes	Percent- age of increase
Washington.....	1,720,000	2,291,400	33
Denver.....	754,800	991,600	31
Alaska.....	43,800	56,900	30
Other field offices.....	93,400	157,700	69
Total.....	2,612,000	3,497,600	34

The production of the Map Reproduction Branch increased more than 25 percent over the past fiscal year. The following is a summary of the production:

	New	Reprint- ed
Topographic Division maps:		
Standard topographic.....	¹ 1,689	159
Standard topographic (Engineers).....		238
1:250,000 scale ²	27	
Scale conversion.....	16	
Planimetric.....	71	4
State base.....	9	5
State topographic indexes.....	87	
Status index.....	4	
Miscellaneous.....	6	129
Geologic Division:		
Geologic quadrangle.....	22	
Mineral investigation.....	23	2
Geologic indexes.....	4	
Coal.....	15	1
Oil and gas maps.....	22	9
Oil and gas charts.....		2
State geologic.....	3	
Geophysical investigation.....	13	
Geologic status.....	2	3
Miscellaneous.....	62	1
Conservation Division: River survey.....	22	
Water Resources Division: Miscellaneous.....	18	1
Total.....	2,115	554

¹ Includes 19 printed by other Government agencies.

² Printed by other Government agencies.

These 2,669 new and reprinted map editions comprise 7,850,454 copies and 38,013,262 impressions, of which 7,701,864 copies and 37,160,272 impressions were printed in the Survey's plant. These maps range in size from 17 by 21 inches to 50 by 72 inches. Among the more difficult maps reproduced were the geologic State maps of Oklahoma, Wyoming, and New Hampshire.

In addition to the foregoing production, 917 jobs comprising miscellaneous maps and other preliminary map services were completed. This printing amounted to 775,817 copies and 3,085,335 impressions, including 167 illustrations comprising 484,840 copies and 1,992,864 impressions for the Government Printing Office. The rest of the miscellaneous printing and service was done for 33 units of the Government, including branches of the Survey and various States. Also, 2,353 type jobs (impressions on cellophane for map preparation) were delivered, and 975 maps were mounted on cloth.

The total cost of all production was \$1,493,157. Of this amount \$24,082 was received from other agencies for copies of maps, and \$19,443 was paid by other agencies for printing or service work. The remainder of the cost \$1,449,632 was charged directly or indirectly to Survey funds.

A summary of the work accomplished within the Survey's plant is as follows:

1. A total of 8,477,681 map copies (40,245,607 impressions) was reproduced and delivered;
2. The Photographic Process Section prepared 12,285 photolithographic printing plates, and the Hand Transfer Section prepared 1,063 printing plates;
3. The Photographic Laboratory made 11,264 photolithographic negatives, 4,106 photographic negatives ranging from 2 by 2½ inches to 30 by 40 inches, 12,195 prints ranging from 1½ by 2 inches to 40 by 72 inches, developed 65 film packs and 33 rolls of film, made 637 lantern slides, developed and printed 58,550 feet of 35-mm. aerial film, and mounted 361 prints.

Public Inquiries Offices

Establishment since June 1950 of five Public Inquiries Offices in Denver, Colo.; Salt Lake City, Utah; San Francisco and Los Angeles, Calif.; and Anchorage, Alaska, has resulted in a substantial improvement in the availability of the results of Survey investigations to the public. These offices carry stocks of Survey maps and reports concerning their respective areas, answer all types of inquiries, and direct specific questions on technical matters to appropriate Division technical officers. Maps and reports are sold "over the counter"; but the offices are not equipped to handle mail orders.

FUNDS

During the fiscal year 1955, obligations were incurred under the direction of the Geological Survey totaling \$46,858,959. Of this

amount 56 percent was appropriated directly to the Geological Survey, 32 percent was made available by other Federal agencies, and 12 percent by States and their political subdivisions.

Obligations incurred by the Geological Survey in fiscal year 1955, by source of funds

Topographic surveys and mapping:

Geological Survey appropriation-----	\$11,498,991
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Reimbursements from non-Federal sources:

States, counties, and municipalities-----	\$1,217,547
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Sale to the public of aerial photographs and photographic copies of records-----	79,480
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Sale of personal property-----	27,339
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		1,324,366
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Reimbursements from other Federal agencies:

Bureau of Reclamation-----	901,941
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Department of the Air Force-----	979,088
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Department of the Army-----	1,045,115
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Department of the Navy-----	25,877
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Atomic Energy Commission-----	159,236
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Miscellaneous-----	69,095
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		3,180,352
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Total appropriation and reimbursements-----	16,033,710
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Direct State payments-----	15,552
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Total, topographic surveys and mapping-----	16,019,261
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Geologic and mineral resource surveys and mapping:

Geological Survey appropriation-----	5,346,472
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Reimbursements from non-Federal sources:

States, counties, and municipalities-----	\$169,674
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Sale of personal property-----	13,255
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		182,929
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Reimbursements from other Federal agencies:

Bureau of Mines-----	40,000
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Bureau of Reclamation-----	101,270
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Defense Minerals Exploration Administration----	416,939
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Department of the Air Force-----	33,601
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Department of the Army-----	1,097,607
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Department of the Navy-----	365,287
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Atomic Energy Commission-----	5,817,458
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Foreign Operations Administration-----	527,946
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General Services Administration-----	268,935
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Government Printing Office—map reproduction---	92,646
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Miscellaneous-----	50,542
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		8,812,231
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Total, geologic and mineral resource surveys and mapping--	14,341,632
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Obligations incurred by the Geological Survey in fiscal year 1955, by source of funds—Continued

Water resources investigations:

Geological Survey appropriation-----	\$6, 658, 580
Reimbursements from non-Federal sources:	
States, counties, and municipalities-----	\$3, 032, 543
Permittees and licensees of the Federal Power Commission-----	103, 555
Sale of personal property-----	26, 610
	3, 162, 708
Reimbursements from other Federal agencies:	
Bureau of Indian Affairs-----	162, 223
Bureau of Reclamation-----	722, 694
Office of the Secretary-----	13, 731
Department of the Air Force-----	71, 434
Department of the Army-----	1, 049, 207
Department of the Navy-----	37, 609
Department of Agriculture-----	134, 932
Department of State-----	119, 749
Atomic Energy Commission-----	278, 314
Foreign Operations Administration-----	311, 847
Tennessee Valley Authority-----	93, 756
Miscellaneous-----	40, 145
	3, 035, 641
Total appropriation and reimbursements-----	12, 856, 929
Direct State payments-----	1, 044, 255
Total, water resources investigations-----	13, 901, 184
Soil and moisture conservation: Geological Survey appropriation--	100, 751
Classification of lands:	
Geological Survey appropriation-----	411, 269
Reimbursements from non-Federal sources: Sale of personal property-----	586
Reimbursement from other Federal agencies: Miscellaneous--	2, 609
Total, classification of lands-----	414, 464
Supervision of mining and oil and gas leases:	
Geological Survey appropriation-----	1, 291, 438
Reimbursements from non-Federal sources:	
Sale to the public of aerial photographs and photographic copies of records-----	\$92
Sale of personal property-----	1, 711
	1, 803
Reimbursements from other Federal agencies: Department of the Navy-----	38, 236
Total, supervision of mining and oil and gas leases-----	1, 331, 477
General Administration: Geological Survey appropriation ¹ -----	750, 190

¹ In addition, funds advanced or reimbursed by other Federal agencies for program expenses bear an equitable share of general administrative expenses. Such charges in 1955 were \$523,894.

Obligations incurred by the Geological Survey in fiscal year 1955, by source of funds—Continued

Summary:

Geological Survey appropriation-----	\$26, 057, 691
Reimbursements from non-Federal sources:	
States, counties and municipalities-----	\$4, 419, 764
Miscellaneous-----	252, 628
	4, 672, 392
Reimbursements from other Federal agencies-----	15, 069, 069
Total appropriation and reimbursements-----	45, 799, 152
Direct State payments-----	1, 059, 807
Grand total-----	46, 858, 959

BUREAU OF MINES

John J. Forbes, *Director*



FOREWORD

RECORD production of helium, progress in developing new techniques for secondary recovery of petroleum, improvements of methods for reclaiming essential metals from scrap, and advancement of fundamental knowledge of explosions were among major accomplishments of the Bureau of Mines during fiscal 1955.

These achievements, and others, were added to a list that began with the Bureau's creation in 1910. Through the years, Bureau researchers, engineers, and technologists have worked closely with those in other organizations to promote fuller and wiser use of our mineral resources and to make safer the jobs of those who extract and process them.

After Bureau metallurgists helped erase shortages of titanium and zirconium during the year, Government plants closed, and commercial firms took over the entire responsibility for producing these vital metals in volume. Bureau fuels technologists found ways to increase recovery and achieve more efficient use of our reserves of coal and petroleum and strengthened the foundation for a great new private industry of the future based on mountains of oil shale that long have lain idle in the West.

The Bureau's work in the field of health and safety earned the respect and wholehearted cooperation of all segments of the mineral industries. Regular inspections of coal mines, coupled with safety training developed in years of intensive research and investigation, contributed immeasurably toward keeping coal-mine accident and fatality rates low as the industry began a steady climb toward normal.

In the realm of economics the Bureau performed outstanding service, both for industry and for the general public. Results of detailed economic and statistical studies on hundreds of mineral commodities, foreign and domestic, were made available regularly to American

businessmen and others interested in the mineral-supply picture. Those who plan for the Nation's military and economic security were kept constantly informed through Bureau reports on the availability of strategic minerals and the economic condition of the industries that supply them. While students from friendly foreign countries received technical training at various Bureau laboratories, the Bureau's own corps of foreign-minerals experts served in faraway lands, giving advice and assistance in the development of new sources of mineral supply.

The fiscal year 1955 saw increased need for the Bureau's services. This need was met despite the exigencies of a Bureau reorganization, carried out in general along the lines suggested by a survey team appointed by the Secretary of the Interior. The reorganization, completed by January 1955 with minimum disturbance of normal operations, permits the helium and health and safety activities to function as separate units and will promote greater overall efficiency throughout the Bureau.

Activities and accomplishments of the Bureau during the year are described in the sections that follow.

MINERAL DEVELOPMENT

The long-term upward trend in mineral consumption in the United States due to population growth, technological developments, and higher living standards was renewed during the fiscal year 1955, as the year saw a reversal of the decline that marked 1953 and early 1954. Despite a relaxation in worldwide tensions, demands for minerals for military production and stockpiling continued strong.

As a result of these and other developments new emphasis was placed on Bureau of Mines work. The Report of the President's Cabinet Committee on Minerals Policy of November 30, 1954, recommended actions to encourage vigorous development of domestic mineral resources and placed certain responsibilities upon the Department of the Interior.

A major function delegated to the Bureau of Mines was joint participation with the Geological Survey in selecting and administering exploration projects undertaken by industry under the Defense Minerals Exploration Administration program. Commodity specialists of the Bureau and the Survey worked with commodity divisions of DMEA in evaluating projects designed to develop new reserves of strategic and critical materials. On-site investigations are made for DMEA by Bureau-Survey field teams whose function is to recommend approval or rejection of applications referred to them. The field

teams likewise supervised and administered DMEA contracts and reported on the final results.

On September 25, 1954, a new building housing the Rare and Precious Metals Experiment Station was dedicated at Reno, Nev., replacing facilities that had become inadequate. Principal research at Reno will focus on the group of new metals whose potentials are just being discovered, but studies on the traditional nonferrous metals will continue.

Consolidations resulting from the Bureau's reorganization resulted in closing stations at Raleigh, N. C., and Mount Weather, Va. In addition, many activities were transferred from College Park, Md., to Reno, Nev., and other stations, and field programing was planned to concentrate research of a particular type at a single laboratory.

During the year an agreement was signed providing joint preparation by the Bureau and the Geological Survey of technological and economic reports requested by the newly formed Office of Minerals Mobilization. Nine reports were completed.

An agreement also was signed between the Department of the Interior and the Office of Defense Mobilization which gave the Department responsibility for preparing and periodically revising material surveys with respect to 45 mineral raw materials. Twelve such reports have been issued, 11 by Mines and Survey; 9 others were being readied.

The Bureau was represented on many technical, industrial, and Government committees and boards, including those of the American Society for Testing Materials, American Institute of Mining and Metallurgical Engineers, and National Academy of Sciences.

Base metals.—Aimed at conserving mineral resources through improved mining methods, three long-range research programs were in progress in cooperation with industry at large copper mines in Michigan, Arizona, and Nevada. These studies will result in better understanding of the structural behavior of rocks and contribute substantially to improving the extraction of ore. Studies of mining methods and costs, important phases of the Bureau's program before World War II, also were resumed to provide up-to-date information to industry.

To increase the reserve base for lead and zinc Bureau experts conducted research on ore discovery, beneficiation of minerals, secondary recovery, and improved zinc-base alloys. Studies of geophysical exploration methods continued in the Racine-Spurgeon area of the Tri-State district, beneficiation methods for oxidized lead ores of Southeast Missouri were investigated, and advance was noted in development of a chemical method to recover zinc through caustic leaching of oxidized ore from Goodsprings, Nev.

As part of a program to increase the recovery of nonferrous metals from scrap or residue, vacuum distillation was employed to obtain high-purity zinc from galvanizers' dross. Progress also was made in improving methods for recovering metals from scrap by using electrolysis, mechanical separation, and selective oxidation.

Development of better zinc-base die-casting alloys received further attention. Alloys containing about 0.6 percent lithium, 3 percent copper, and 7 percent aluminum were found to have outstanding properties. This series is being investigated further along with the influence of other elements alloyed with high-purity zinc.

Encouraging developments in salvaging tin from slimes resulted from the Bureau's study of recovering ultrafine mineral particles. Research continued to reduce metal losses at the Government-operated tin smelter in Texas, and methods for recovering tin from accumulated slag also were investigated,

Laboratory techniques developed to recover a bulk sublimate of cadmium, germanium, and other metals from zinc concentrates may lead to economic ways for increasing the recovery of these metals at zinc plants. Although cadmium was in plentiful supply, a growing demand for the metal is anticipated.

A compilation of information on domestic occurrences and resources of mercury was under way to facilitate expanded production in an emergency. Widespread occurrence of mercury-antimony ores in Alaska leads to the belief that large reserves may be found, and the Bureau continued its research on extraction methods aimed at utilizing the material.

Ferrous metals and alloys.—The Bureau program for iron and steel was directed toward long-term planning for increased domestic iron-ore output and improved production technology. Successful beneficiation tests were made on low-grade iron ores from the Pacific Northwest, the Southeast, and Texas. Over 100 bulk samples of Lake Superior taconite were taken, analyzed, and classified by metallurgical type. This was part of a comprehensive study to determine the extent and grade of deposits and develop metallurgical methods. The Bureau's blast furnace was enlarged and redesigned so that test results would closely approximate those attained in commercial practice. Use of anthracite as a partial substitute for coke in iron and steel production was undertaken, with encouraging results.

Further advances were made in the lance-injection method for removing or adding certain elements in steel manufacture. Other programs seeking to improve steelmaking techniques and steel quality included a study of the effects of rare-earth elements upon the mechanical properties of carbon and low-alloy steels, basic research in high-temperature reactions with slags and gases, and the use of east Texas ores in a two-step electric-furnace operation. To reduce

the melting time in steelmaking furnaces, a portable, top-fired furnace for preheating scrap before charging was investigated, with promising results.

Efforts to reduce the Nation's dependence on foreign supplies of manganese were based on continued investigation of domestic raw-material resources and metallurgical research to develop effective recovery methods for subgrade and refractory manganiferous materials. Standard ferromanganese was produced from Artillery Peak, Ariz., ore by concentration, sintering, and electric furnace smelting. A new acid-leach process for beneficiating manganese ores also was examined. In another area of research a manganese-copper alloy with exceptional vibration-damping capacity was developed. This will have valuable applications by the Bureau of Ships and in industry.

Experimental roasting and leaching methods for upgrading chromite ore were developed to enable production of metallurgical-grade chrome from low-grade Montana deposits, the principal domestic source of this strategic mineral. Continued testing to develop more ductile high-purity chromium determined that very small quantities of nitrogen lowered the ductility. Refractory mortars that met Federal specifications for Grade A superduty mortars were prepared from domestic chromite and magnesia.

As a result of a drilling program that had established large reserves of nickel ore in the vicinity of Nicaro, Cuba, work was begun in October 1954 on a 75-percent expansion of the capacity of the nearby Government-owned processing plant. Metallurgical research by the Bureau was continued to devise improved beneficiation methods for the ore and investigate methods for recovering the iron, chromium, and cobalt contents. Near the end of the year the Bureau made a 2-year agreement with GSA that will permit acceleration of the metallurgical research program on the Cuban ore.

Light metals.—Assistance was given industry through tests made to beneficiate alumina and bauxite. Bureau researchers found it possible to decrease the iron content of the alumina specimens while the bauxite was successfully upgraded into a material suitable for manufacture of alum. Laboratory tests demonstrated that the alumina content of Bayer-process residues and high-silica bauxites could be recovered by a lime-soda sintering process.

Research also progressed in the reduction of low-grade aluminous materials by electrothermal smelting methods. Refining of the crude product, by partly cooling the molten alloy and then filtering, yielded aluminum and silicon master alloys suitable for the aluminum industry.

Research completed during the year resulted in development of a wider range of magnesium-lithium-aluminum alloys, with improved physical properties. Basic information provided by the Bureau con-

tributed greatly to the development of techniques for utilizing these lightest and most ductile of the magnesium alloys in fabricated parts for aircraft and missiles.

The Bureau halted titanium production at its pilot plant at Boulder City, Nev., in September. Under a contract with the GSA's Emergency Procurement Service, 246 tons of acceptable titanium sponge for national defense had been produced from July 1953 until the plant closed. The project also provided information that enabled the Bureau to make a more accurate economic and technical evaluation of the thermic process for producing titanium sponge. This method involves reduction of titanium tetrachloride by magnesium.

Near the year end a cooperative agreement was signed with the Wah Chang Corp. under which the Bureau will conduct research on an improved process for producing titanium sponge. Part of the Boulder City pilot plant was reactivated to carry out the project.

Bureau studies on extractive and physical metallurgy of titanium advanced during the year. An electropurification process for titanium metal appears adaptable to commercial production of high-purity titanium, and valuable facts were obtained from research in reducing titanium chloride by sodium. Reports for the technical world were published on electrodeposition of titanium metal, chemical and galvanic corrosion of titanium, welding of titanium, and fabrication and utilization of titanium metal and its alloys.

Aiding the GSA, the Bureau examined and analyzed titanium metal offered for sale to the Government by private producers. Bureau representatives also were engineering consultants to the GSA on Government titanium production and research contracts let to industry.

Rare and precious metals.—The Bureau's search for deposits of uranium and thorium ores for the Atomic Energy Commission resulted in the discovery of several potentially important sources of fissionable elements in Idaho, Georgia, Montana, South Carolina, and Washington. Commercial development was begun in Idaho and South Carolina to recover strategic minerals from placer deposits first pointed out by Bureau investigations. Under a contract with the AEC, Bureau technologists analyzed and evaluated over 25,000 mineral samples submitted by the public and believed to contain fissionable elements. This compares with some 11,000 samples tested the previous year.

During the first half of the year the Bureau's Northwest Electrodevelopment Laboratory at Albany, Oreg., again was the principal supplier of the zirconium and hafnium required by the AEC. However, production by industry, which had adopted the Bureau-developed process, increased to the point where the Albany output no longer was needed, and so the plant was closed.

An agreement between the Bureau and the AEC established a new research program centering on development of thorium. In cooperation with the GSA, a successful pilot-plant demonstration was made of a process for extracting columbium and tantalum from tin slags and domestic ores.

Recognizing the growing industrial need for selenium, the Bureau and the GSA cooperated in an accelerated program to develop sources of this critical material. A drilling program was begun on seleniferous tuffs near Lysite, Wyo., to determine the grade and extent of the ore. At the same time, research was started for recovering selenium from these low-grade deposits.

An intensive research program was begun at the new Reno, Nev., station to devise extraction and separation methods and to determine the physical properties and applications of the so-called rare-earth metals and their compounds. The Bureau anticipates important industrial uses for many of these materials, which only recently have been available in appreciable amounts through ore discoveries and as byproducts of thorium production.

Ceramic and fertilizer materials.—The Bureau's experimental "planer," a mechanical mining machine, was used successfully in one section of a Montana phosphate-rock mine. This area had been abandoned as unsafe for conventional mining methods. The extraction rate in one test approached 1 ton per minute. Changes in design were made on the basis of performance data. With the cooperation of industry, further tests in other mine areas are planned to provide additional data on continuous mining under varying conditions. Meanwhile, research continued on beneficiation techniques intended to permit utilization of larger quantities of low-grade western phosphate rock. Preliminary studies also were made of methods to utilize phosphatic slime from the Florida and Tennessee phosphate-rock-washing operations.

Samples of low-melting synthetic micas were prepared for industrial evaluation as bonding agents for grinding wheels. Several mica-nickel cermets were prepared, using normal fluorphlogopite mica, boron micas, and nickel-containing micas. Other research was undertaken for methods of growing large crystals of synthetic mica and of improving the strength and flexibility of reconstituted mica sheet. New techniques for growing large crystals by differential cooling from a shallow melt and by slow withdrawal of a seed crystal from a mica melt were not immediately successful. The most promising development in forming reconstituted synthetic mica sheet was utilization of a fugitive mineralizer during hot-pressing. Reports on several phases of synthetic mica research were published.

Plans for the coming year include further tests on the production of large mica crystals by the slow withdrawal method; investigation

of a new technique of internal resistance melting to improve furnace operations, decrease power costs, and possibly increase crystal size; and a study of the basic factors involved in preparing reconstituted sheet from synthetic mica flake. Long-range plans include investigation of the properties of other types of potentially useful synthetic mica compounds and systematic measurement and cataloging of information on the physical properties of synthetic fluorine micas.

Research advanced on the preparation and properties of artificial abrasives, such as carbides, silicides, borides, and nitrides, to determine their suitability as substitutes for industrial diamonds. A survey of the world supply of crude abrasive materials and manufactured abrasive products was begun.

Reports of the ceramic resources of the Pacific Northwest and refractories consumption in California and Nevada were prepared for publication. Reconnaissance investigations of refractory clay resources in Colorado were substantially completed, and similar investigations were planned in Utah and other Rocky Mountain States.

Pilot-plant studies of the recovery of kyanite and sillimanite from the tailings of a Florida ilmenite-monazite operation were completed. It was found that a mixed concentrate of the 2 minerals having less than 5 percent total impurities can be obtained. Successful application of the process would provide several thousand tons of concentrate per year, since the tailings contain up to 20 percent combined kyanite and sillimanite.

Construction and chemical materials.—Rapidly changing market conditions in the fluorspar industry and a decline in domestic output of fluorspar caused the Bureau to launch a detailed study of this strategic material. Special reports were prepared for Federal defense agencies responsible for stockpiling and other programs affecting this commodity. Deposits of fluorspar were examined, and methods of beneficiating fluorspar ores were being developed. Laboratory work continued on the problem of recovering fluorine from waste gases created during the processing of phosphate rock.

Several reports reviewing accomplishments of the Bureau in the synthesis of asbestiform fibers were being prepared, and one was nearly completed. Studies still were under way in this field and also on beneficiation processes for natural asbestos. A detailed report on the asbestos industry was prepared for publication. In the field, drilling in Maine revealed some asbestos, but more exploration is required to evaluate its potential. In Venezuela a Bureau engineer examined an asbestos mine that was being considered as a possible source of strategic grade asbestos for the National Stockpile.

Experience during the past several years has demonstrated the need for more detailed information on sulfur resources of the United States. Consequently, the Bureau compiled data on this commodity

and began preparing several circulars which will be issued when studies are completed.

Because ample supplies of cement and aggregates are essential to continued growth of the construction industry, basic facts compiled by the Bureau on these commodities were widely used by organizations concerned with major construction programs and policy. A special survey necessary in developing a national road-construction program was made of future cement-production capacity. Since there is an urgent need for work on mineral-aggregates problems the Bureau plans to increase its research in this field.

Miscellaneous research on minerals.—Bureau research regarding the fundamental properties of materials has led to outstanding publications on physical properties of rocks and compounds. The basic data developed played an important part in the preparation in 1954 of a manual for the Army Corps of Engineers entitled "Design of Underground Installations in Rock." The manual was nearly completed at the end of the year.

Instruments were developed for studying large-scale caving methods of mining, and field application will progress during the coming year in cooperation with industry. Developments by the Bureau included a camera and caliper for inspecting boreholes as small as 3-inch diameter to depths up to 2,000 feet.

Fundamental testing of blasting methods continued. One phase involved the use of high-speed motion-picture cameras to photograph blasting scenes at taconite and limestone operations.

The year's work on fundamental ore dressing included tests on flotation, electrostatic separation, and ultrasonic energy. Also investigated were methods for producing synthetic minerals and compounds that may replace scarce minerals. Like most of the miscellaneous research the results of this work will be reflected in commodity research and development during coming years.

Studies of mining methods and costs in cooperation with industry were accelerated, and a manuscript on western uranium-mining methods was completed.

PETROLEUM AND NATURAL GAS

Petroleum and natural-gas production.—The important study of the effects of different drilling fluids on the permeability to oil of reservoir rocks immediately surrounding a well bore neared completion and will reveal the degree of contamination by different liquids commonly used in completing petroleum and natural-gas wells. Substantial progress continued on clay studies, and the Bureau plans to broaden the scope of identification by X-ray diffraction not only to clay minerals but other minerals that are important in studies of reservoir

rocks. Studies of Wyoming oil and gas fields for the Missouri Basin Field Committee of the department will be continued at the Laramie, Wyo., station, but the Arkansas-White-Red River Basin studies conducted at the Bartlesville station terminated at the end of the year. Volume 1 of a three-volume monograph, Phase Relations of Gas-Condensate Fluids, will be published by the end of 1955 in cooperation with the American Gas Association.

Twenty-three reports and papers on scientific and engineering research concerning primary and secondary petroleum-recovery operations and River Basin cooperative studies were completed. Similar scientific and technical reports will be continued in selected areas and fields in Texas, Oklahoma, Kansas, Louisiana, Arkansas, California, Wyoming, Pennsylvania, and West Virginia.

Laboratory experiments to evaluate the most adaptable radioactive substance for a water tracer indicate that iridium 192 probably will be usable without undue absorption in an underground reservoir. Other important laboratory research evaluated the effectiveness of more than 200 detergents in petroleum-sand systems by the centrifugal method and revealed that several well-balanced nonionic detergents are effective for oil displacement; other results seemingly indicate that the detergent solution enters into a sand formation previously impermeable to water.

Studies of porphyrins in Colorado oil shale and water-spray extracts of a California crude oil were completed, and reports were prepared. A study of deasphalting crude oil by propane precipitation is nearly completed, and similar progressive laboratory work will be continued. Considerable laboratory work was done to evaluate the fundamental properties of Appalachian oil-reservoir rock, and the project will continue.

Another cooperative study with the American Gas Association on the deliverability of natural gas from underground storage reservoirs resulted in five tests in fields in Oklahoma, Kansas, West Virginia, and Pennsylvania. Preliminary results reveal that a gas-storage reservoir of high and uniform permeability and relatively free of water will receive and deliver gas in an identical manner. A significant study of the flow of natural gas through experimental pipelines and transmission lines was completed and will be published as a monograph by the American Gas Association.

The new Division of Petroleum came into being January 2, 1955, and several organizational and planning conferences were held. A steering committee was formed to review and reorganize the Bureau's production-research program on a national and unified basis and eliminate possible duplication. The Appalachian Experiment Station, Morgantown, W. Va., was dedicated May 14; the Secretary of the Interior delivered the principal address.

Chemistry and refining.—Noteworthy progress was made in all current phases of the Bureau of Mines petroleum-chemistry, refining, and thermodynamics program at the Laramie, Wyo., and Bartlesville, Okla., stations.

A study on nitrogen in petroleum was initiated during the year; the major objective was quantitative identification of nitrogen compounds in certain crude oils. Progress was made in concentrating and separating the nitrogen compounds in a Wilmington, Calif., crude. In a supplementary phase of the work two pure nitrogen compounds were prepared as standards for research groups.

A study of sulfur in petroleum resulted in identification of 2 sulfur compounds in Wasson, Tex., crude oil and of 2 in Wilmington, Calif., crude. Development of methods for separating sulfur compounds by types from complex mixtures was emphasized. In another phase of the work, 4 purified sulfur compounds, Nos. 29 through 32 in a series, were prepared during the year, and 5 standards, previously prepared, were distributed.

In cooperation with the Western Petroleum Refiners' Association and the Bureau of Ships, studies of the causes of storage instability of diesel-type fuels indicated that oxidation is a major cause of gum formation in distillate fuels, that oxygen-susceptible sludge-formers are concentrated in aromatic fractions of the fuels, and that, contrary to usual belief, polar materials in some cases inhibit sludge formation. The stability studies were extended during the year to include preliminary work on gasoline. Research on the combustion of diesel-type fuels provided tentative correlations of air-fuel ratio with ignition delay.

Surveys and reports on the quality of petroleum fuels included 2 on motor gasoline and 1 each on aviation fuels and diesel fuels. A survey of burner fuels was begun.

Analyses of 209 domestic and foreign crude oils were completed, and several publications were issued, including a comprehensive report to the Air Materiel Command that contains analytical data for about 94 percent of the oilfields in the United States now producing over 2,500 barrels daily.

Thermodynamics research, conducted in cooperation with the American Petroleum Institute and the Air Research Development Command, included nitrogen compounds for the first time. Measurements of heat capacities in solid and liquid states, heats and temperatures of phase changes, and entropy in the liquid state were completed for six pure organic compounds. Heats of combustion were determined for 9 compounds and for 4 sulfur and oil mixtures, and a special combustion technique for tetraethyl lead was developed. Heats of formation were determined for two fluorine compounds. Vapor heat capacities and heats of vaporization were obtained for 3

compounds, and vapor-pressure studies were completed for 2 compounds. Calibration of equipment previously constructed for pressure-volume-temperature relationship studies was completed, and measurements of neopentane were begun. A similar apparatus for use with gaseous materials was designed. Calculation of the thermodynamic functions of 2 compounds was completed, revisions based on new information were made for the functions of a third compound, and similar calculations progressed for 5 other compounds.

Petroleum and natural-gas economics.—The year was one of adjustment for the oil industry. By holding domestic production of crude oil to 2,316 million barrels while total demand rose to 2,959 million barrels, excessive stocks of both crude oil and products were largely liquidated. There were small increases—about 3 million barrels in each instance—in imports of both crude oil and refined products, bringing the respective totals to 239 and 144 million barrels.

The 52,925 wells completed and the 29,773 producing oil wells drilled during 1954 represented an alltime high. The degree of success obtained also rose, as 55.5 percent of the wells drilled resulted in oil producers last year compared with 54 percent in 1953. Despite the large number of wells drilled and relatively high ratio of oil producers, estimated reserves of crude petroleum increased only 616 million barrels during the year. This was one of the smallest increases since the end of World War II.

Marketed production of natural gas in 1954 was 8,667 billion cubic feet, 3.2 percent greater than in the preceding year and the smallest increase in recent years, reflecting the slowing in pipeline construction. The increase in proved reserves of natural gas (264 billion cubic feet to a total of 211.7 trillion) was also the smallest since World War II, although the 3,977 gas wells completed represented a record high.

OIL SHALE

Oil from oil shale.—During the past year laboratory work continued on the properties and composition of both oil shale and shale oil. Nearly 6,000 samples of oil shale were assayed, and logs of more than 200 sections of Green River shale were published. Studies on the composition of the organic matter (kerogen) of shales from Rifle indicate that there is little difference in the material from the various Green River shales of the region. Tests continued on partial solution of oil shale in various organic solvents. Up to 60 percent of the kerogen was soluble upon mild pyrolysis in selected glycols, but the portions going into solution in the various solvents have not been identified. Up to 70 percent of the kerogen was extracted by tetralin under similar conditions. Hydrogenation of kerogen in the presence of stannous chloride yielded up to 80 percent of the products soluble in

benzene. The products were saturated hydrocarbons and neutral nitrogen, sulfur, and oxygen derivatives.

Work on the naphtha fraction of N-T-U shale oil has been completed, and the results will be published in a technical report. Progress has been made in the study of the gas-oil fraction. Identification of the major constituents by molecular distillation, thermal diffusion, and spectrometric analysis is underway. Characterization of the oils produced in the entrained-solids retort at high temperatures was begun.

In the work on the entrained-solids retorting method the effect of operating temperature on yield and composition of the products was studied in greater detail. Recycle hydrogenation of both crude shale oil and entrained-solids oils has been investigated further. The results indicate that better fuel may be obtained from all these products by mild hydrogenation.

In the first part of the year shale was mined to supply feed for the two pilot plants. A large rotary-drilling frame was designed and installed in the mine, and extensive tests on horizontal rotary drilling were planned. However, all activity terminated February 28 when a serious roof fall in the mine damaged some of the mining equipment. At the year end the mine remained closed, and a study of possible alternate mining methods was being made by a group of consultants appointed by the Director of the Bureau.

After preliminary shakedown tests, plants 2 (30 tons per day) and 3 (150 tons per day) were operated. Progress was made in plant 2 in determining good operating conditions and in studying the effect of artificial nucleation on size of oil droplets in the retort gases. In one series of tests in retort 3 good mechanical operation was achieved at a moderate rate of throughput, and good distillation of shale oil resulted. However, because of secondary cracking or failure to recover all the fine oil mist, the total yield of recovered oil was not as high as formerly obtained in the smaller retorts.

Experiments with the smaller pilot retort 1 (6 tons per day) gave additional support to the theory that addition of small quantities of sodium chloride as brine has considerable beneficial effect on the formation of shale-oil mist with a resulting increase in overall yield.

HELIUM

A record-breaking output of helium and specific plans to increase the production of this lightweight nonflammable gas by 50 percent were foremost among many attainments during the year.

Greater emphasis on this important responsibility of the Bureau resulted, with creation of a new organizational system under which all helium activities were centered under an Assistant Director, re-

porting directly to Washington with headquarters at Amarillo, Tex.

The 4 helium plants at Amarillo and Exell, Tex.; Shiprock, N. Mex.; and Otis, Kans., shipped 212 million cubic feet of helium, a gain of 25 percent over 1954. Approximately 70 percent went to Federal agencies and 30 percent to commercial customers. A survey disclosed that 90 percent of all helium is used for defense purposes.

Despite production above rated capacity, output fell behind demands, and the Bureau was authorized to invest \$6 million in new facilities for extracting helium from certain natural gases.

New safety records were set simultaneously with the increased output, and outstanding marks were made by the plants at Amarillo and Otis. Citations were received from the Texas Safety Association and the National Safety Council.

For the first few months of the year helium shipments were limited because of a tank-car shortage. Better utilization of cars and acquisition of additional transportation equipment helped relieve the shortage of shipping containers. At the year end 17 helium tank cars were on order, and arrangements were made for the Bureau to operate and control all 107 Government-owned cars. Since approximately 80 percent of the older cars needed repairs, rehabilitation work was started under contracts awarded near the year end.

Plant security measures were strengthened by resumption of a 24-hour-per-day guard service at all plants in accordance with suggestions from the Office of Naval Intelligence.

Water encroachment reduced the production of wells serving the Navajo plant, and a contract was negotiated with Stanolind Oil & Gas Co. for delivering helium-bearing gas from a new field 8 miles from the plant. The Bureau estimates that the move will extend the life of the Navajo installations several years—perhaps 5 or more.

High helium demands and full production rates placed additional emphasis on plant engineering and development. Besides preliminary engineering design, feasibility studies, and cost estimates for new plants an improved helium-separation cycle was devised that promises considerable reduction in power requirements. Other developments included installation of automatic controls on helium-separation equipment, resizing of compressor cylinders to restore capacity lost by reduction of gas-supply pressure, regrouting of compressor foundations, installation of a pilot-size fractionation column to check data required in constructing a new plant, cleaning of cooling systems with chemicals, and installation of equipment to remove hydrogen in the final purification of helium.

A research group continued to analyze samples of natural gas from new fields and studied several areas to determine whether they could supply a new helium plant.

Other research included studies of helium liquefaction to simplify transportation, behavior of natural gases as an aid to process improvement and equipment development, instrumentation to improve process control and minimize operating manpower, and utilization of helium.

Estimated helium demands for the fiscal year 1956 are 20 percent higher than those for fiscal 1955, proportionately distributed between Federal and commercial users. During the first 6 to 8 months of fiscal 1956 demand was expected to be 20 percent greater than production, necessitating continued allocation of helium.

SOLID FUELS AND EXPLOSIVES RESEARCH

Last year, as in every year since its creation, the Bureau of Mines furthered technical progress in the mining, preparation, and utilization of the Nation's solid-fuel reserves and continued its authoritative studies of explosives and explosions. The year saw completion of the Bureau's portion of an inventory of the Nation's minable reserves of coking coal, start of research to determine whether atomic energy can help man obtain liquid fuels and chemicals from coal at low cost, and accumulation of new knowledge of the basic mechanisms involved in explosions.

Coal mining and reserves studies. Bureau engineers studied various types of continuous coal-mining machines during the year and suggested a method of applying a Canadian-developed machine to longwall mining in this country. They also observed longwall operations, in bituminous-coal mines, of four imported German coal planers under varying conditions of bed thickness and friability. Preliminary tests with the Bureau's vibrating-blade coal planer indicated that this type of machine can be used to mine anthracite. Tests are continuing to improve design and operation of the planer and accessory equipment.

Estimates of known recoverable reserves of coking coal were published for 5 counties, 2 in West Virginia and 1 each in Kentucky, Pennsylvania, and Tennessee. Reports for 14 additional counties were drafted as the Bureau terminated fieldwork in this investigation.

Coal preparation.—The Bureau continued studies to develop effective methods of cleaning and recovering fine sizes of coal. Two types of equipment tested—a dense-medium cyclone cleaner and a feldspar jig—proved adaptable to this use. Changing the design of the cell used in the kerosine-flotation process for cleaning and dewatering fine coal increased its capacity.

Preparation characteristics of coking coals from counties in West Virginia, Kentucky, and Tennessee were given in reports which also

discussed the possibility of upgrading these coals to present metallurgical standards. Work continued on coals from other counties in these States.

Commercial-scale crushing tests of Chestnut-size anthracite indicated that ring- and gyratory-type crushing equipment gives best recovery of Buckwheat and Rice sizes. Power requirements for crushing and pulverizing lignite were determined, and factors causing lignite to freeze in railroad cars were studied.

Drying, combustion, and carbonization.—A pilot-scale entrained-bed drier and fluidized-bed carbonizer at Denver were used to produce chars from western coals for blending in the production of metallurgical coke. The same equipment was used in studies to develop more efficient methods for removing solids from hot distillation products. Observations continued at Rockdale, Tex., where nine 50-ton-per-hour driers used the Bureau's entrained-bed system to supply dried lignite to power boilers, and a prototype carbonizer was operated to provide tar and light oil which are being tested for properties and uses.

A comprehensive report on the technology of lignitic coals, including a review of European lignite technology, was published. A study showed that covering mine refuse piles with fine refuse material or clay would prevent or quench fires. An institutional-type incinerator to burn wastes with minimum emission of smoke and particulate matter was constructed and tested.

The Bureau's experimental blast furnace at Pittsburgh was employed to investigate possible metallurgical uses for anthracite. Production rate, fuel consumption, and sulfur content of the metal produced were favorable when anthracite was used in ratios up to 40 percent of the fuel burden. Anthracite showed promise when used in a metallurgical blast cupola in amounts varying from 10 to 40 percent of the anthracite-coke fuel charge.

Yield and quality of coke and products from 41 American coals and 33 blends were determined by the Bureau of Mines-American Gas Association carbonization tests. The Tuscaloosa and the sole-heated ovens were used to determine expanding properties of coals and blends, using inert materials such as anthracite fines and petroleum coke. Thermal and oxidation pretreatments of coals gave data on the basic mechanism of carbonization.

Coal-to-oil research.—With expiration of the Synthetic Liquid Fuels Act on April 4, 1955, laboratory-, bench-, and pilot-scale research on producing synthetic fuels from coal was integrated with the Bureau's other research and technologic work on coal.

Conversion of coal to liquid fuel by reaction with hydrogen at high temperatures in a 1-step instead of the conventional 2-step process was studied in a small, continuous reactor. Conversion of coal to oil was

nearly complete, but the product was mostly heavy oil with relatively small yields of gasoline and gaseous hydrocarbons. Similar products were obtained in pilot-plant tests of this process, but difficulties due to overheating were encountered, necessitating redesign of the reactor.

Progress was made in research to gain a better understanding of the structure of coal, which can lead to development of methods for converting coal to other useful substances. Carbohydrates, cellulose, and lignin (with or without hydrogen) were heated or treated with sulfuric or phosphoric acid to produce coallike chars. Infrared absorption spectra were used to compare coal fractions with products from coal hydrogenation, petroleum asphalt, and gilsonite and to follow structural changes during coal carbonization. Examination of coal by X-ray diffraction indicated the presence of minute crystals—additional proof that coal is composed of material that has a recognizable structure. Research was begun on microbial degradation of coal and related substances.

Steel turnings, the cheapest known catalyst for the Fischer-Tropsch process for converting synthesis gas into organic chemicals, were specially treated for one modification of the process in which cooling oil is pumped through the catalyst bed. Tests showed that the turnings were an excellent catalyst for this oil-circulation process, that the active surface layer of the catalyst was largely converted to iron carbide early in the synthesis, and that the carbide content then remained essentially constant, but metallic iron slowly oxidized to magnetite.

In experiments to develop improved methods of activating and pretreating catalysts, turnings that were carbided or nitrided before synthesis had relatively low activity, but subsequent oxidation and reduction resulted in high activity. Higher activity was observed with a steel containing copper and with oxidized turnings of carbon steel impregnated with copper nitrate. Oxidized steel wool also was active.

Coal-to-gas research.—A pilot plant for gasifying coal with oxygen and steam at high pressures is being developed. In acquiring design data for the plant and its equipment, Bureau scientists are using statistical methods that enable them to test several variables at the same time, reducing the number of tests that must be made.

In cooperation with the Atomic Energy Commission the Bureau has begun research to determine whether nuclear energy can be used for gasifying coal with steam alone. The AEC plans to work on development of a reactor, and the Bureau will test materials and attempt to work out a practical chemical process for atomic gasification. Preliminary work already is in progress on analyzing products obtained with a model reactor heated by electricity.

What may prove to be a means of feeding coal into a high-pressure gasifier was developed from experiments in which slurries of powdered coal and water were passed through hot coils to vaporize the water and break the coal particles further. The rate of reaction of steam with carbon was measured in an apparatus that permitted introduction of other gases, such as oxygen or nitrogen, and observation of coal particle size.

Tests with a vortex gasifier, in which unburned residues were recycled, pointed toward eventual reduction of materials requirements per unit volume of product gas. Bench-scale gasification tests of lignite gave data for the design of a pilot-scale unit for moderate-pressure gasification in a fixed bed of lump lignite with oxygen and steam at temperatures permitting liquid-slag removal.

Research on production of high-B. t. u. gas from synthesis gas produced from coal resulted in pilot-scale development of a fluidized-bed, multiple-inlet reactor that gave higher gasification rates and gas of higher heating value than fixed-bed reactors. Studies of methanation catalysts gave data on reactivation properties and useful catalyst life.

Work on gasification of unmined coal underground was reactivated in cooperation with industry at Gorgas, Ala., and a test was made to determine whether a hydraulic fracturing process used in oilfields is practical for opening passages in coal seams for gasification. Passages were opened in the coal bed by injecting a mixture of oil and sand. Permeability of the bed was increased 85-fold, and there was evidence that openings extended some 600 feet from the injection point. Gasification tests are in progress.

Coal constitution and analysis.—The Bureau's coal sampling and analysis work continued to provide the basis for the Government's coal-purchasing program. More coal-dust analyses were made in connection with inspections of coal mines, and other Bureau research programs required analyses of cokes, rock dust, slags, and other materials. Cooperation was continued with the American Society for Testing Materials and the International Organization of Standardization in development and standardization of methods of coal analysis. Cooperative work with the Economic Commission for Europe brought closer agreement on an international system of classifying lignite and brown coals. A Bureau-sponsored conference on coal microscopy reviewed recent developments in coal petrography and applications to coal-industry problems.

Services to the Government.—Advisory services to Federal agencies on installing, testing, and operating fuel-burning equipment continued. Boiler-water samples were analyzed for Federal agencies, recommendations made for proper treatment, and feedwater testing kits and special chemicals distributed. Assistance to State and munic-

ipal governments on air- and stream-pollution problems continued, and a new method of determining density of smoke emission from chimneys was compared with the long-used Ringelmann method.

Coal economics.—After hitting a postdepression low during the 12 months ended October 1954 production of bituminous coal began to climb steadily. However, production of Pennsylvania anthracite continued to decline.

Statistical and economic research on solid fuels provided analyses of factors involved in coal's changing competitive position, in the volume and method of production and consumption, and in stocks, imports, and exports of coal. Special data were interpreted for estimating solid fuels mobilization requirements, including those for steel and other strategic industries. Important data on coal, coke, coal chemicals, foreign solid fuels, operations, and energy trends were provided to various members and committees of Congress and to other Federal and State agencies.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Explosives testing and research.—During the fiscal year the Bureau made more than 2,800 tests of permissible and other explosives and hazardous chemicals; 168 explosives were on the active permissible list at the end of the year. Consumption of permissibles was about one-half million pounds more than in the previous year. The ratio of permissibles to black blasting powder was 15 : 1.

Revised testing schedules for blasting devices, stemming devices, and explosives were issued. A marked increase in the number of permissible field samples failing to meet minimum safety requirements led to a program for improving the safety of permissibles with a record of field-sample failures. To date, changes have been authorized in the formulation of four brands.

Measurement of the temperature of an exploding charge by means of its luminosity was used to develop further a theory of the detonation of explosives. Such measurements were made for PETN, tetryl, RDX, and TNT. In studying firedamp ignition by explosives, such factors as charge weight, borehole geometry and loading, stemming, and atmospheric humidity were investigated.

Photographic evidence was obtained of a possible mechanism in the detonation of gas mixtures.

Dust- and gas-explosion research.—Explosibility of 75 mineral and industrial dusts was evaluated, and wire-screen coverings for vents in industrial equipment were studied as a means of simultaneously relieving pressure and quenching flame in dust explosions.

The effectiveness of wet rock dust as an antiexplosion measure was tested in the Bureau's Experimental mine at Bruceton, Pa. Tests were made on natural gas-air mixtures at high pressures to determine the hazards of igniting mine atmospheres that may be drawn into compressed-air coalbreakers.

Flammable gases and liquids tested for explosive properties included hydraulic fluids used in aircraft or naval vessels, industrially important straight-chain saturated alcohols, aromatic and paraffin hydrocarbons, and various organic compounds.

In research on ignition and combustion processes, several long-range studies on the oxidation of hydrocarbons were concluded. Oxygen also was found to play an important role in the exchange reaction between hydrogen and deuterium. Investigation of flame structure and behavior continued, with emphasis on the development of new techniques for studying the structure and propagation of turbulent flames.

As in previous years, assistance was given Government agencies, municipal authorities, and industries in tracing the origin of explosions and fires, such as the U. S. S. *Bennington* disaster, and in eliminating potential accidents due to gas leaks; improper handling and storage of hazardous materials; and other causes.

HEALTH AND SAFETY

Bureau of Mines activities for safety and health in the mineral industries were reorganized during the year to provide direct supervision from Washington. In December the principal field offices were designated health and safety offices reporting to the Assistant Director—Health and Safety.

Investigations to determine the causes of accidents and injuries and recommendations for eliminating them continued to meet with success as reflected by improved safety conditions.

The inspection of coal mines and enforcement of the Federal Coal Mine Safety Act of 1952 saw correction of many hazardous conditions and noticeably better accident records. Training of workmen and supervisors in recognizing and eliminating dangers was accelerated.

One coal-mine explosion classed as a major disaster occurred during the year.

Work on primary hazards.—The most serious hazards are those involving roof and haulage. Roof falls caused 55 percent of all fatalities in coal mines in 1954 and haulage accidents another 23 percent, or 78 percent from both. A national campaign to reduce the number killed and injured by falls of rock and coal was under-

taken jointly by the Bureau and mineral-industry organizations. Favorable results are expected.

Roof bolting, a method of support that the Bureau introduced to the coal-mining industry in 1947, has proved its effectiveness in preventing roof-fall fatalities and continues to gain wide acceptance. During the year 120 underground mechanized coal mines used roof bolts exclusively, and 26 percent of the entire production of bituminous-coal mines came from roof-bolted areas. Significantly, of the 177 roof-fall fatalities in bituminous-coal mines during 1954, only 2 resulted from failure of the bolts to hold the roof.

In future the risk of failure of bolted mine roof may be lessened by using a safety device known as a roof-bolt compression pad. Seeking to make roof-bolting installations more reliable, the Bureau developed during the fiscal year 1955 a rubber-in-steel bearing plate. A similar device now is in volume production by industry and promises to be an effective warning of impending failure of bolted roof.

Recent field and laboratory tests provided information for determining anchorage effectiveness, torque-tension relationship, and load-carrying capacities of different bolts and expansion shells normally used in mines. A report describing the Bureau's findings will be available to the mining industry during the coming fiscal year.

The Bureau conferred during the year with mining-company officials, inspectors of State mining departments, and engineers from various parts of the United States and foreign countries on roof-bolting and roof-control problems. Roof-bolt installations in all districts were surveyed, and reports were submitted to miners' unions, operators, and State inspectors. Other phases of roof control included studies of extensible canopies, shields on continuous mining machines, curved jacks for longwall continuous mining machines, and bonding and roof painting.

Tests of equipment.—The Bureau's electrical-mechanical test work contributed greatly toward increased safety in coal mines.

During the year 165 approvals and 2,043 extensions of approvals of electrical equipment were granted, and a study was continued on safe lighting for gassy or dusty mines.

To assist the Navy in eliminating fire and explosion hazards on aircraft and in ships the Bureau tested 12 electrical components and 3 aircraft fuel gages.

Other research centered on diesel-powered equipment and fire resistance of conveyor belts.

Gas-ignition and fire hazards from portable electrical cables constitute major problems that Bureau researchers are planning to study more intensively in coming months.

Seventeen approvals and 20 extensions of previous approvals were granted for dust collectors for use in drilling rock in coal mines. One new approval was issued on an air-line respirator, and 41 extensions of approval were granted on respiratory protective equipment. Apparatus was developed for testing respirators against paint-spray mists.

A new Experimental coal mine was essentially completed on Government property at Bruceton, Pa., and will be used for testing drill-dust collectors and other studies of mine-dust problems.

Health.—Activities concerned with health research continued to yield direct benefits to the mining and allied industries. Promotion of safer and more healthful working conditions helped conserve manpower, its most valuable resource.

The continuing study of the composition of mine atmospheres provides the Bureau of Mines with information on this subject accumulated on a nationwide basis. The results obtained in this work are available to State mining departments, the mining companies concerned, and the miners' unions. In connection with recovery operations at a West Virginia coal mine after an explosion Bureau experts made many gas analyses at the scene and facilitated reopening of the mine.

In addition to this field assignment, laboratory technicians analyzed over 18,000 additional gas samples, most of which had been obtained in the coal-mine-inspection program. Others were collected from sealed fire areas in coal mines, metal and salt mines, tunnels under construction, and coal-preparation plants or in connection with tests of diesel and butane engines and decomposition of plastics and conveyor belting.

Studies continued for the Navy's Bureau of Ships to determine ignition and burning characteristics and the nature and volume of toxic gases produced by combustion or thermal decomposition of plastic materials.

On behalf of a committee consisting of Bureau personnel and representatives of conveyor-belt manufacturers, coal operators' associations, the miners' union, and the State of Kentucky tests were conducted to determine the gaseous products formed by burning or thermal decomposition of conveyor belts. Work of the committee resulted in a proposed schedule of acceptance requirements for fire-resistant belting.

A special infrared spectrometer was installed to determine both qualitatively and quantitatively the type and amount of explosive gas in coal-mine atmosphere.

Control of dust produced by continuous-type mining machines is one of the problems confronting the coal-mining industry. In addi-

tion to analyses of hundreds of mine-dust samples obtained underground the Bureau began to study the behavior and flow pattern of air currents as related to dust transport. A scale model of two connected mine entries was constructed for this project. Other researchers observed the effects of various types of spray nozzles as dust suppressors and arranged to conduct field studies of this problem.

A survey was completed during the year of dust-control measures in the coal-mining industry which showed that about 24 percent of the mines practice some form of dust control. Information provided by the more than 3,400 replies to a questionnaire on dust control was prepared for publication.

At the request of the International Labor Office, Geneva, Switzerland, an annual summary was prepared reviewing methods of dust prevention and suppression in mining, tunneling, and quarrying.

A major portion of the American Standard Code concerning respiratory protection was rewritten by Bureau personnel serving on an ASA sectional committee named to correlate material on head, eye, and respiratory protection.

Complete ventilation surveys for three coal mines were made. Records of a study of the effect of barometric-pressure changes on the emission of explosive gas in caved areas of an Illinois coal mine were analyzed, and a manuscript was prepared for publication. A study was begun of the effectiveness of bleeder entries in keeping caved areas in coal mines free of methane accumulations.

Accident analysis.—Surveys of accident trends and causes continued to play essential roles in the Bureau's long-range program of curbing injuries in the mineral industries. Injury statistics and employment figures were obtained in the coal, coke, quarrying, metallurgical, non-metallic-mineral, and petroleum and natural-gas industries.

In addition to preparing publications for industry, agencies of the Federal and State Governments, unions, trade associations, and others interested in safety promotion, Bureau statisticians arranged special reports that aided Federal coal-mine inspectors in their work.

The 30th National Safety Competition and 4 other safety competitions were conducted during the year under sponsorship of trade associations of the mineral industries. Approximately 1,500 mines, quarries, and other mineral plants were enrolled in these contests, and some 2,000 Certificates of Accomplishment in Safety were prepared and presented the employees and managers at the plants.

Other accomplishments included the annual canvass among manufacturers of industrial explosives, preparation of three Minerals Yearbook chapters regarding injuries and related employment experiences, and release of monthly reports on the fatal- and nonfatal-injury experience at coal mines.

During the year the Branch of Accident Analyses in Washington took over work previously handled by the Statistical Service Branch at College Park. The transfer resulted in substantial savings.

In the coming year deadlines will be advanced for completing and issuing statistical information without increasing personnel or equipment.

Safety education.—The year saw increased activity in the organization of accident-prevention classes among coal-mining men. Since 1947 approximately 125,000 persons have taken the Bureau's 20-hour training course. Although instruction is primarily for workmen, it has helped morale when both supervisory officials and workmen take the course together. In fact, recent emphasis has been placed on 100-percent participation by both groups.

During the coming year the Bureau will further emphasize 100-percent training wherever an accident-prevention training course is given. The ultimate goal is to make the training available to each person who goes underground in the coal-mining industry. In the coming year the Bureau also will continue accident-prevention training for the mining industry other than coal and for the petroleum and natural-gas industries.

Special efforts were made during the fiscal year 1955 to promote organization of Holmes Safety chapters and councils. The campaign resulted in creation of 130 such chapters and 6 councils. These promote safety because they encourage the discussion of accidents and safety measures by men and management.

The Bureau's goal is safety training for every workman and official in the coal-mining industry and retraining at regular intervals.

Coal-mine inspection.—This year marked the third complete year under the Federal Coal-Mine Safety Act, which consists of title I (the original Federal Coal-Mine Inspection and Investigation Act of 1941, with slight changes) and title II (containing certain mandatory provisions designed to prevent explosions, fires, inundations, and man-trip and man-hoist accidents in coal mines regularly employing 15 or more persons underground.)

There were approximately 8,400 active coal mines in the Nation in 1954, including 1,570 title II mines, 5,515 small title I underground mines, and 1,275 strip mines. At the end of the fiscal year 1955 the Division of Coal-Mine Inspection had 258 coal-mine inspectors, 45 engineers, 9 coal-mine electrical inspectors, and other supporting personnel variously assigned in coal-mine inspection and safety educational work.

During the year 3,595 regular inspections were made of coal mines covered under title II of the act, including 52 made jointly with State inspectors in States that have entered into cooperative agree-

ments with the Bureau under the act. In addition, 2,794 special inspections were conducted to determine the abatement status of violations cited under title II. Inspectors observed 8,230 violations of the safety provisions of title II during these inspections. Many were corrected immediately, obviating the need for issuing formal notices of findings; however, the Bureau issued 3,063 original notices setting a reasonable time for abating dangers not corrected promptly, 523 notices granting time extensions, and 3,041 notices certifying that the dangers had been abated.

Orders requiring the withdrawal of men were issued at 100 mines, 84 orders at 59 mines under the act's imminent danger clause and 71 orders at 41 mines for failure to show good faith in abating violations within a reasonable time. In addition, 21 orders were issued classing heretofore "nongassy" mines as "gassy." However, five of these orders later were annulled by the Director or the Federal Coal-Mine Safety Board of Review, an independent agency set up by the act.

Federal inspectors and engineers also made 6,827 inspections of the smaller title I mines, including 595 inspections of strip mines; 1,012 technical surveys of electrical, ventilation, dust, blasting, and other practices and conditions; and 625 special investigations of fatal and serious nonfatal accidents and mine fires and gas and dust ignitions.

During the fiscal year 1955, 7 applications for annulment of gassy-classification orders issued under the act were made to the Director; 6 were denied, and 1 was annulled. The Board received three applications for annulment of gassy classification, all appealing adverse decisions by the Director. The Board annulled one order, and the Director has petitioned the United States Court of Appeals. A hearing is pending.

The Board also received two applications for annulment of withdrawal orders. One, issued under a State-participation plan, was annulled upon abatement of the violation. The other, appealing an adverse decision by the Director, was annulled following a hearing. This action was appealed by the Director to the Federal Court, which dismissed the litigation because it was not filed within the 30-day limit.

One major disaster, a widespread explosion and coal-mine fire that caused the death of 16 men, occurred during the year. This is the second major disaster (one in which 5 or more persons are killed) in 3 years of operation under the antidisaster provisions of title II of the act. The other was a dust explosion, which in 1953 caused 5 deaths.

Preliminary figures indicate that the number of fatalities in coal mines dropped from 460 in 1953 to 395 in the calendar year 1954, but the frequency rate per million man-hours of exposure increased from

0.84 to 1.04. During the first 6 months of 1955 the preliminary fatality frequency rate was also 1.04. This unfavorable trend is usually experienced during periods of tight markets and marginal operation of coal mines and is influenced by the decreasing man-hours now required for coal production.

Control of fires in inactive coal deposits.—Since 1949 the Bureau of Mines has engaged in controlling fires in inactive coal deposits on private property and the public domain.

Of the 196 known fires in inactive coal deposits, 46 have been controlled or are being controlled. Of these, 26 are on the public domain and 20 on private property. The Bureau estimates that one quarter of a billion tons of coal have been conserved at a cost to the taxpayers of less than 1 cent a ton.

During the year 8 fire-control projects were completed; 6 were on the public domain and 2 on private property. Five additional fires were being controlled at year's end.

New fire-control projects will be started during the coming year under funds appropriated by the Congress.

RIVER-BASIN ACTIVITIES

The Bureau continued to cooperate with other Federal, State, and private agencies to develop resources of United States river basins. Bureau investigations assured that the mineral industry and mineral potential in each region received adequate consideration in planning water and power development.

Arkansas-White-Red River Basins.—Bureau field studies of all the more important mineralized areas in these basins culminated in a comprehensive report, *Minerals and Geology of the Arkansas-White-Red Basins*, written by Bureau engineers in cooperation with the Federal Geological Survey and various State officials. Presenting long-range plans for developing the mineral resources of the area, it was part of an all-resources inventory report and development plan for the basins requested by the Congress in the Flood Control Act of 1950. The entire report by all agencies was completed in June 1955.

Five special treatises describing in detail the mineral situation in major subareas were submitted to cooperating agencies, as were many special reports on mineral resources in specific proposed water- and power-project areas.

Procedures used in evaluating mineral-production losses because of inundation in reservoir areas were studied and the findings incorporated in a preliminary report.

Missouri River Basin.—Continuing lignite-storage studies revealed that weathering of the surface of lignite piles causes heating, which

is aggravated by wind and drifting of lignite dust, making erection of "snow fences" and periodic leveling of drifts necessary. Carbonization and tar-yield studies were made of samples from many lignite deposits.

Commercial development of petroleum and natural gas in the Missouri Basin was exceptionally active during the year. Brought into production were 4,205 new wells, 122 new oilfields, 50 new gasfields, 6 natural-gasoline plants, and 3 refineries. Reports on petroleum and natural gas in the Williston Basin, the Cheyenne River Division, and the Missouri-Souris Division were prepared for the Missouri Basin Field Committee.

Seven reports on metallic and nonmetallic resources of the Basin were presented to the committee. They included: Mineral Resources of the Powder River Division (Montana and Wyoming), Missouri Basin Chromite, Cement Industry Feasibility Study, A Review of the Aluminum Industry, Gypsum in Wyoming and Colorado, Lightweight Aggregates in North and South Dakota, and Mineral Resources in the Northern Missouri Coal District.

New England-New York Survey.—In cooperation with the Federal Geological Survey and State geologists, mineral-industry studies were prepared for inclusion in a 46-volume resources inventory and development plan prepared by the New England-New York Interagency Committee.

A study of sources of waterborne mineral wastes was conducted in the New England-New York work. In this study mineral wastes were inventoried and sampled at 1,025 mineral-industry plants. Technical assistance was given at several plants.

Other river basins.—Special studies, reviews, and reports were prepared for many other areas, including Alaska, in connection with water and power development, both Government and private.

FOREIGN ACTIVITIES

As the gap between domestic production and domestic consumption of many mineral commodities has continued to widen, work of the Bureau's Foreign Activities Division came into sharper focus during the year.

Bureau undertakings in this field include foreign fact-finding and analysis, technical assistance to underdeveloped countries, and training of foreign technologists in Federal laboratories. The importance of these phases of the Bureau's work has been growing in recent years, reflecting great contribution by foreign sources to United States mineral supply, expanding investment by American capital in the development of foreign minerals, and active participation of our Government

in international economic affairs. In recognition of this trend, the activity was given division status in reorganization of the Bureau on January 1, 1955.

Service to industries.—American industries, planning future operations, drew heavily on the Bureau's ability to analyze foreign mineral developments and their effect on the economy of this and other countries. The extent of utilization of foreign-produced minerals by the land of origin and by competing nations, the probability of increased or decreased output, technologic advancements, and market trends for American-made mining machinery and related equipment—all entered into the fact-finding program of the Bureau's specialists.

During the fiscal year 1956 a small increase is planned in the headquarters staff of foreign minerals specialists in Washington and in its corps of expert observers assigned to nations where developments in the production and utilization of minerals are significant. The expansion is necessitated by the growing number of requests from industry, other Government agencies, and foreign governments for data and advice on international mineral affairs and reflects congressional instructions to certain Federal agencies concerned with foreign minerals to look to the Department of the Interior for information and guidance.

Investments by American business in the development of foreign mineral resources appear destined to grow with the rapidly increasing demand for minerals in the United States. Depletion of resources has combined with growing industrial demands in recent decades progressively to widen the gap between production and needs in several raw materials. Examples of primary importance are copper, lead, zinc, and petroleum, which now are imported in substantial quantities, whereas before World War II the United States was virtually self-sufficient in these vital commodities.

Technical assistance.—In cooperation with the Foreign Operations Administration (now the International Cooperation Administration) the Bureau conducted technical-assistance projects in 11 countries—Afghanistan, Brazil, Colombia, Cuba, India, Israel, Liberia, Mexico, Pakistan, Peru, and the Philippine Islands. In the fiscal year 1956 projects will be undertaken in Egypt and Indonesia, and work at Nepal will be resumed after a year's lapse. Most of these assignments are filled by a single specialist for each country, who serves in an advisory capacity. The Bureau considers accomplishments in technical progress and in consolidating good will with the host countries to be outstanding, even though the outlay for such services has been modest.

From time to time, technical assistance is provided under direct contracts with foreign governments at their expense in fields where

the Bureau has specialized knowledge not available from private consultants. Typical is an agreement with Brazil under which unique knowledge attained by the Bureau in the field of oil-shale mining and retorting is helping Brazil in developing her oil-shale resources. During the year Brazilian officials expressed appreciation for the help received and requested a 2-year extension of the contract.

Foreign trainees.—The training of mineral technologists from foreign countries in the laboratories, pilot plants, and other installations of the Bureau continued as an important part of the Government's foreign-assistance program. During the year 12 trainees from 7 African, Asiatic, and Latin American countries completed courses ranging from a few months to a year. At the year end 11 were receiving such training, and plans call for doubling the number next year.

Almost without exception, men trained by the Bureau have attained positions of high responsibility upon return to their native lands and have continued to maintain friendly relationships with their former associates and instructors. Exchange of technical information has been mutually helpful.

MINERAL ECONOMICS

The Bureau's long-range analyses of economic factors affecting the mineral industries became increasingly significant during the year. Special emphasis was placed on methods of expanding supplies, both domestic and foreign, to meet emergency conditions and estimation of total requirements and use patterns in peace and war.

Studies were undertaken to determine major economic factors influencing the welfare of the lead and zinc, antimony, fluorspar, and coal industries. Factors investigated included long-term domestic and foreign market trends, imports, domestic and foreign primary and secondary production, and relations among national economic activities and prices, production, and consumption of these commodities. Various potential assistance programs were evaluated and estimates made of their cost to taxpayers and consumers and the probable benefits to the mining industries and the industries serving them. Possible consequences of these proposals on price and cost structures and consumption patterns also were estimated.

In studying foreign supply factors for other minerals, trends of imports, the impact of tariffs on imports, and Government actions concerning international trade in minerals were under continuing analysis and review. The role of foreign supply was assessed as part of the total resource base for individual minerals. Long-run results of foreign trade-liberalization policies on prices of minerals and on

foreign investment in minerals and potential aftereffects of built-up foreign capacity were summarized.

Research in minerals taxation involved such items as the treatment of expenditures at various stages in developing mineral properties, financial relationships between percentage depletion and loss carry-over, and estimation of the effect of different percentages of depletion allowance on mineral production, exploration, and development. The relative tax advantages of selecting oil payments as against an overriding royalty were computed for specific situations. Many tax proposals were examined in cooperation with the Treasury Department to determine their effects on mineral industries.

Assistance was given the newly created Office of Minerals, Mobilization. Analyses were made of the supply-requirement position of the Nation for certain critical metals and minerals under partial and full mobilization. Work was begun to establish mobilization programs and to estimate their economic implications for all critical minerals. Economic analyses for reports to OMM were completed on antimony, fluorspar, battery-grade manganese, tungsten, and selenium.

The Bureau's contribution to the Federal interindustry research program neared completion with publication of final reports on demands for and plant-investment requirements of selected strategic minerals.

PUBLIC REPORTS

Keeping industry, educators, research workers, and others informed of its advances in mineral technology, the Bureau of Mines continued to issue many formal reports during the year in fulfilling a basic requirement of its organic act.

The 653 manuscripts approved and edited during the fiscal year 1955 compared with 587 the previous year and were related to all phases of the agency's work.

Among the 215 reports sent the Government Printing Office were 99 technical bulletins, 94 Minerals Yearbook chapters and 3 bound volumes with extensive indexes, and 19 miners' circulars, handbooks, and miscellaneous guides. The 163 manuscripts prepared for processing included 85 reports of investigations and 35 information circulars—13 more than in the previous year—together with 15 issues of Mineral Trade Notes and 28 miscellaneous reports, such as materials surveys and chapters of the Bureau's Administrative Manual. In addition, 275 papers for technical and safety societies and articles prepared for the trade and technical press were edited.

During the year the Bureau's industry-sponsored technical-educational motion pictures continued in high demand and were used in thousands of schools throughout the Nation and in Alaska and

Hawaii in regular audiovisual programs. Films were shown 210,103 times to more than 57 million persons, either at group showings or on noncommercial television programs, compared with approximately 31 million the previous year. The number of individual prints available for circulation increased 11 percent, but demands for films remained higher than the availability of copies.

Texas and Its Natural Resources, one of the most popular films in the Bureau's library, was revised during the year, and several new subjects were in production at the year end.

Besides Pittsburgh, Pa., Bureau films were circulated through nearly 200 nonprofit subdepositories at leading educational institutions, libraries, visual aid centers, and Armed Forces installations.

ADMINISTRATION SUMMARY

Following detailed studies of the activities and organization of the Bureau of Mines, changes in its organizational structure were made during fiscal 1955. The number of regions was reduced from 9 to 5; helium activities were separated from other Bureau functions and placed under an Assistant Director; all health and safety activities were placed under direct supervision of an Assistant Director with divisions for health, safety, and coal-mine inspection; a program staff was created in the Washington office in charge of an Assistant Director; and a Division of Foreign Activities was set up. During the year, management of the Bureau's anthracite program was placed under direct charge of the Division of Solid Fuels in Washington.

A summary of Division of Administration activities follows:

Property

Property inventories were completed at all Bureau stations during the year. A central warehouse was set up in Denver, Colo., for storing heavy equipment needed in future programs. Also, central drill-core-storage warehouses were established at Denver Colo., and Minneapolis, Minn., and an area drill-core-storage warehouse at Bauxite, Ark. The Bureau's motor-vehicle fleet had been reduced by 67 at the year end—almost a 7-percent cut from the previous year's 988—without impairing efficiency. Still further reductions are planned. The Bureau disposed of \$175,000 in excess property during the year and collected \$9,790 from the sale of scrap.

The Procurement Manual was distributed and is in use throughout the Bureau.

Property records of the Bureau of Mines, as of June 30, 1955, show accounts as follows:

Automotive equipment-----	\$2, 122, 819. 04
Canvas, composition, leather, and rubber goods-----	21, 270. 10
Drafting and precision-engineering instruments-----	120, 751. 38
Electrical equipment-----	528, 523. 86
Hardware-----	526, 265. 10
Household furnishings-----	134, 910. 73
Laboratory apparatus and appliances-----	8, 078, 513. 38
Medical and surgical appliances-----	60, 384. 36
Office furniture, appliances and floor coverings-----	2, 845, 431. 82
Photographic and projection apparatus-----	346, 457. 01
Powerplant and general shop equipment-----	4, 309, 477. 73
Real estate-----	31, 212, 821. 37
Specialized equipment-----	5, 866, 354. 56
Total-----	56, 173, 980. 44

A records-control schedule, covering departmental records, field records, and general administrative records, was issued as a guide in carrying out the Bureau's records-management program.

Finance

One of the primary results obtained from the cost-finding accounting system of the Bureau, which has been in operation for the past fiscal year, is data on the costs of maintaining various facilitating services throughout the Bureau. Information has been developed that will aid materially in effecting economies in overhead expenses, which in turn will provide more efficient utilization of the funds appropriated for research work.

The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1955, including direct appropriations, prior year balances available, reimbursements, advances, and transfers from other Government agencies, proceeds from helium operations, and contributions to trust funds from non-Government sources, were \$38,432,721. Of this amount \$27,796,105 was obligated, leaving an unobligated balance of \$10,636,616, much of which was construction money destined for a new helium plant.

Funds available to the Bureau of Mines for fiscal year 1955, by source of funds

Direct appropriation-----	\$25, 481, 000
Prior year balances available-----	4, 224, 843
Less transfers and returns-----	-1, 453, 424
Reimbursements from other Government agencies-----	219, 652
Advanced or transferred from other Government agencies-----	5, 408, 467
Proceeds from helium operations-----	4, 095, 952
Contributions from trust funds from non-Government agencies-----	456, 231
Total, Bureau of Mines-----	38, 432, 721

Obligations incurred by the Bureau of Mines in the fiscal year 1955, by appropriation

Conservation and development of mineral resources-----	\$13, 297, 250
Health and safety-----	5, 045, 183
Construction -----	106, 967
General administrative expenses-----	960, 762
Working funds (includes all consolidated and allocated working funds)-----	5, 222, 714
Administrative expenses, Mutual Security Act, executive (transfer to Interior)-----	26, 970
Technical assistance, American Republics and non-self-governing Territories of the Western Hemisphere, executive (transfer to Interior)-----	¹ —4, 247
Technical cooperation, general, executive (transfer to Interior)----	283, 756
Mutual defense financing, defense support, economic and technical assistance, Formosa and the associated States of Cambodia, Laos, Viet Nam, executive (transfer to Interior)-----	424
Mutual defense financing, defense support, economical and technical assistance, Europe, executive (transfer to Interior)-----	2, 580
Economic and technical assistance, defense support, Asia and Pacific other than Formosa and the associated States of Cambodia, Laos, and Viet Nam, executive (transfer to Interior)-----	44, 244
Economic and technical assistance, Near East and Africa, executive (transfer to Interior)-----	¹ —1, 338
Development and operation of helium properties-----	2, 378, 100
Contributed funds-----	432, 740
Total obligations incurred-----	27, 796, 105

¹ Disbursement less than carryover obligation.

Personnel

Reorganization.—The reorganization required considerable personnel planning and oral and written instructions to both the Washington office and the field and a tremendous amount of processing, which involved, for the most part, the preparation of numerous position descriptions and an unusually large number of personnel actions to reflect current assignments under the reorganization.

Manual.—Nine chapters of the Bureau of Mines Manual were issued. In addition seven chapters were completely revised in line with current statutes and regulations.

Schedule and number of paid employees

	GS	CPC	Ungraded	Total
Departmental-----	581			581
Field-----	2, 937	97	647	3, 681
Total-----	3, 518	97	647	4, 262

Classification.—Greater emphasis was placed upon desk audits of positions, field surveys and inspections, and conferences and discussions with supervisors and employees to assure compliance with classification procedures. In line with this emphasis on-the-spot studies were conducted of positions at 12 field stations.

Employee safety.—Efforts have continued to reduce to a minimum the number of accidents and the severity of resulting injuries in all phases of Bureau operations. A report of accidents and man-hours of exposure was devised to show accident cause and injury classification as an aid in directing accident-prevention efforts.

Incentive awards.—Following are some of the attainments under the incentive award program showing increased employee participation and increased savings to the Government:

Number of suggestions received during the year-----	245
Number of suggestions receiving awards-----	66
Total of cash awards granted-----	\$1, 160
Suggestions resulting in estimated annual savings-----	19
Total of estimated annual savings-----	\$72, 297. 50
Suggestions that resulted in intangible savings-----	47

OFFICE OF OIL AND GAS

Hugh A. Stewart, *Director*



THE Secretary of the Interior and the Assistant Secretary, Mineral Resources, were leaders in obtaining coordination of oil and gas policies and the administration thereof, and provided leadership in serving as channel of communication with the petroleum and gas industries.

They were active participants in meetings of the Defense Mobilization Board and the Presidential Advisory Committee on Energy Supplies and Resources Policy. In February 1955, the President's Advisory Committee made its report and recommendations aimed at strengthening the national defense, providing orderly industrial growth, and assuring energy supplies for our expanding national economy and for any future emergency.

They participated in meetings of the National Petroleum Council and the Military Petroleum Advisory Board, both industry advisory groups, established by the Secretary of the Interior, from which the Federal Government receives advice and information on a wide range of petroleum and gas matters affecting the national economy and the defense of our country. In addition, they have personally presented the Department's important oil and gas policies and views with respect to significant departmental activities directly to the Congress, and to the petroleum industry in public addresses.

The Secretariat was supported by the Office of Oil and Gas, where through the Director and the Federal Petroleum Board, the Department maintained active and close cooperation with the States in enforcement of their oil and gas conservation laws through administration of the Connally Act, and by the regular participation of the Director, as the Department's official representative, at meetings of the Interstate Oil Compact commission.

Executives of this Office were engaged in the work of the North Atlantic Treaty Organization Petroleum Planning Committee and

its Working Group, and participated in several meetings held in Europe. An Assistant Director of this Office served as adviser to the United States Delegation at meetings of the NATO Petroleum Planning Committee and an executive of the staff was chairman of the Working Group.

Through the Office of Oil and Gas the National Petroleum Council has cooperated with the Federal Government for almost 10 years. The NPC provided valuable reports on the petroleum productive capacity of the United States, petroleum imports, petroleum storage capacity, shale oil, use of radio and radar in the petroleum industry, and matters concerned with assuring an adequate petroleum supply in event of an attack upon the United States.

Also, the National Petroleum Council published two important manuals as a service to Government and industry. One, Disaster Planning for the Oil and Gas Industries, is a manual primarily for use of management in connection with disaster planning. It contains ideas and suggestions to guide companies in the formulation of plans and programs of advance preparations to reduce damage to and facilitate the rehabilitation of refineries, and in providing continuity of company operations in event of disaster. The other manual, Security Principles for the Petroleum and Gas Industries, is a guide for industrial defense planning for use at the plant level to provide uniformity, eliminate inconsistencies, and furnish policy guidance for establishment and administration of security programs in the oil and gas industries.

Through the Office of Oil and Gas in cooperation with the Military Petroleum Advisory Board, the Department of the Interior, the Department of Defense, and the Office of Defense Mobilization have for their guidance the first petroleum report ever prepared which considers enemy attack damage resulting from the use of ultra-modern weapons of warfare. That report is a milestone in petroleum defense preparedness planning. The report is the basis for many detailed technical studies under way by this Office and committees of MPAB.

Functions and responsibilities authorized by the Defense Production Act of 1950, as amended, vested in the Secretary of the Interior and delegated to this Office concern petroleum and gas. The Voluntary Agreement Relating to Foreign Petroleum Supply, as amended, dated April 15, 1954, and its implementing adjunct, the Foreign Petroleum Supply Committee, continued in existence throughout the fiscal year under the supervision and direction of a Director appointed from the Office of Oil and Gas by the Secretary of the Interior. Information covering foreign petroleum operations which is indispen-

sable to Government was received throughout the fiscal year through the Committee and its four subcommittees, namely, Production Subcommittee, Refining Subcommittee, Supply and Distribution Subcommittee, and Statistical Subcommittee. These subcommittees gathered information and prepared reports on various aspects of petroleum operations in friendly foreign nations, pursuant to specific requests of the Secretary of the Interior or the Director of the agreement. These activities increased with progressive intensity during the fiscal year, primarily because of the increased requirements of the Department of Defense for foreign petroleum data for use in connection with strategic planning. The information and estimates supplied, covering more than 80 foreign nations and areas, concerned the foreign aviation gasoline supply position reported periodically on a 2-month forward basis, requirements of petroleum products for 1954 extended on a wartime basis through several years, crude oil producing operations under normal and wartime conditions, petroleum products consumption and supplies, petroleum refining capacity, and civilian terminal and storage facilities throughout the free world. These are comprehensive reports. Significant is the report on foreign civilian terminal and storage facilities which was the first of its kind ever prepared for use of Government. It consists of four volumes totaling 3,388 pages of statistical data on 1,084 terminals in 120 countries. Although the report was prepared at the request and mostly for the use of the Department of Defense, it was supplied to other Federal agencies having need for such data. As the fiscal year ended, the committees were working on revisions of this report, and on the preparation of other reports to comply with Government requests for information.

The Secretary of the Interior appointed 62 persons to serve on the Gas Industry Advisory Council which was available to obtain the advice and counsel of the gas industry in connection with the discharge of the defense responsibilities with respect to gas delegated to the Secretary of the Interior under the Defense Production Act of 1950.

Industrial expansion goals for expansion of the petroleum and gas industries were maintained throughout the fiscal year. Progress had been made toward reaching the goals which had been established for (a) increasing United States refining capacity, (b) increasing natural gas liquids capacity, (c) construction of additional alkylation facilities, (d) additional oil storage facilities, (e) construction of additional oil pipelines, and (f) expansion in pipeline capacity of the gas utilities industry. The petroleum and gas industries used the incentive of accelerated tax amortization provided by the Inter-

nal Revenue Code for expansion to meet the mobilization goals. This Office reviewed, analyzed, and submitted over 300 reports and recommendations to the Office of Defense Mobilization for approval or denial of certificates of accelerated tax amortization. Numerous requests for time extensions and scope amendments on certificates of accelerated tax amortization were analyzed and reports and recommendations were made to ODM. From time to time studies and reviews were made with respect to the expansion goals and the use of rapid tax amortization for petroleum and gas projects. Near the end of the fiscal year this Office had under way studies of each of the established goals to bring all information and data up to date to use as a basis for recommendations to the Office of Defense Mobilization for changes or modifications in the light of improved mobilization conditions.

This Office has cooperated with the Congress in furnishing information to Members of Congress and congressional committees, covering facts related to the petroleum and gas industries and their operations and the outlook for petroleum and gas supply both in times of peace and war.

The Office has membership on Department of Commerce committees which handle matters relating to export controls. A series of many meetings were necessary to develop and revise a master export security list, and other meetings were held frequently to consider matters on exports.

The Office gave advice and information to many Government agencies on matters involving petroleum and gas. These included the Executive Office of the President; Office of Defense Mobilization; the Departments of State, Treasury, Defense, Army, Navy, Air Force, Justice, Agriculture, Commerce, and Labor; the emergency agencies, Defense Transport Administration and Federal Civil Defense Administration; independent agencies, Atomic Energy Commission, Central Intelligence Agency, Civil Aeronautics Board, Federal Power Commission; as well as to representative of foreign governments.

The Department was represented at meetings of international petroleum organizations. The Secretary of the Interior, Assistant Secretary, Mineral Resources, and an executive of this Office represented the United States Government at the World Petroleum Congress, in Rome, Italy, in June 1955. The Director of this Office served as an official representative of the United States at a meeting of the Petroleum Committee of the International Labor Organization at Caracas, Venezuela, in April 1955.

In standardizing departmental nomenclature the Oil and Gas Division was redesignated as the Office of Oil and Gas. The change was effective April 6, 1955.

CONNALLY ACT ADMINISTRATION

The Office of Oil and Gas supervises the activities of the Federal Petroleum Board in administering the Connally Act. This act prohibits interstate shipment of oil produced in violation of certain State oil and gas conservation laws and orders issued thereunder. The Board initiated and conducted investigations, including holding of hearings, with respect to production and interstate shipment of such contraband oil with the view of supporting the oil and gas conservation policies of the respective States.

The Federal Petroleum Board, composed of a Chairman and two members, maintains headquarters at Kilgore, Tex. Suboffices are located at Midland and Victoria, Tex., and Lafayette, La. On January 1, 1955, the office formerly located at Houston was transferred to Victoria.

While the act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling of oil, its chief application is in the States of Texas, Louisiana, and New Mexico, where regulations prescribed under the act are actively enforced. So far as possible with the resources at its command, the Board enforces the provisions of the act in other oil-producing States, particularly in Oklahoma, Mississippi, Kansas, and Arkansas. Enactment of legislation in 1955 by the Colorado Legislature brings that State within the purview of the Connally Act.

Producers, refiners, transporters, and others handling oil and products in a designated area are required to keep prescribed operating records and file monthly reports with the Board on approved forms. The designated area consists of 106 counties in the State of Texas, the counties of Lea and Eddy in the State of New Mexico, and the entire State of Louisiana.

From this designated area the Board received and processed, each month, approximately 7,233 monthly producers reports, about 493 monthly pipeline reports, and 76 reports from processors and refiners. These reports covered operations in 2,458 separate oilfields, and account for approximately 65 percent of the entire domestic production of crude oil in the States of Texas, Louisiana, and New Mexico, or approximately 3,968,000 barrels daily.

During the fiscal year, nearly 4,000 leases were inspected, some 2,900 leases were actually visited and checked, and 10 pipelines were checked. In the performance of this work, 645 oilfields were visited and 1,193 interviews conducted.

At the beginning of the fiscal year, 10 cases dealing with violations of the act were pending, 1 in an investigative status, 1 pending review by the Board, 3 under review by the Department of Justice in Wash-

ington, 4 pending disposition by the United States attorneys, and 1 was under review by the Solicitor's office.

Eight new investigations were started during the fiscal year. Nine cases were on the Board's docket when the fiscal year ended, of which five were in the investigative stage, two under review in the Solicitor's Office of the Department, one pending review by the Board, and one pending disposition by the United States attorneys.

During the fiscal year, one case was closed administratively without prosecution, and eight cases were closed by successful prosecution in the Federal courts, resulting in the imposition and payment of \$86,400 in fines.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

C. O. Mittendorf, *Administrator*



THE Defense Minerals Exploration Administration continued to carry out during the fiscal year 1955 its program to encourage exploration for deposits of strategic and critical minerals in the United States, its Territories and possessions, under a delegation from the Office of Defense Mobilization to the Secretary of the Interior.

Assistance to private industry is provided under the program by the Government, through DMEA, participating in the costs of exploring for indicated or undeveloped sources of strategic and critical minerals. The Government participates to the extent of 50 or 75 percent of the cost of the exploration, depending upon the mineral being sought. Funds for the Government's share of the cost of exploration are allocated from the borrowing authority of the Defense Production Act of 1950, as amended. If, in the opinion of the Government, the project has been successful in finding ore, a certification of discovery or development is issued, and the contribution to the project made by the Government is repayable on a percentage-royalty basis on the net sales receipts from any ore produced from the property on which the exploratory work was performed.

Based upon sound engineering and geological principles, exploration projects are agreed upon by the Government and the mine operators under contracts calling for specific work to be performed within specified costs.

The program is administered by DMEA with a small Washington staff and five field auditors. Technical field services are provided through the cooperation of the Geological Survey and the Bureau of Mines. Participation by private industry in the program is widespread and includes individuals, partnerships, and corporate enterprises. The program appeals especially to small mine operators, as evidenced by the large number participating.

During the fiscal year 1955, 472 applications for Government aid in exploration projects were received. The total number of applications received since the beginning of the program in mid-1951 to June 30, 1955, was 2,693 and included requests from 41 States and Alaska. In the 12-month period ending June 30, 1955, 120 contracts were executed by DMEA, bringing the total number of contracts executed since the inception of the program to 767. These contracts represent exploration projects in 32 States and Alaska, and include 28 commodities. At the beginning of the fiscal year 1955, the number of contracts in force was 249, but dropped to 208 at the end of the fiscal year. From the start of the program to date, a total of 60 contracts have been cancelled without any work having been done on the projects. Government commitments on contracts executed during the past 12 months amounted to \$3,083,815, and now total \$22,454,915. The total estimated cost of the projects covered by the 120 contracts executed in the past 12 months, including the participation of industry, was \$5,077,136 and for the 767 contracts executed since the start of the program aggregated \$36,894,860.

Sixty-nine certifications of discovery or development of deposits of strategic and critical minerals were issued by DMEA during the fiscal year 1955. The total project cost of these 69 certifications amounted to \$3,343,973. The Government was committed to participate to the extent of \$2,116,018 on these projects, but only \$1,559,144 was actually expended by the Government. The total number of projects certified by DMEA as of June 30, 1955, was 201, having an aggregate project cost of \$9,138,706. Participation by the Government in these projects was set at \$5,703,081. However, the Government has contributed only \$4,394,059 to date, inasmuch as work on some of the terminated projects was completed at less cost than anticipated and several of the other contracts are still in operation. At the end of the fiscal year 1955, the Government had received repayments from 206 operators amounting to \$963,122. This sum included repayments from 15 operators for the full amounts of the Government's participation in their projects.

The 201 certifications were on projects involving a search for antimony, asbestos, beryl, cobalt, columbium, copper, corundum, fluorspar, iron, lead, manganese, mercury, mica, monazite, nickel, rutile, sulfur, talc, tantalum, tin, thorium, tungsten, uranium, and zinc. Thirty-eight of the certified projects were in North Carolina; 28 in Colorado; 19 each in Idaho and Utah; 12 in Arizona; 10 each in California, Montana, and Nevada; 9 in Wisconsin; 8 in Washington; 7 in South Dakota; 3 each in Alabama, Alaska, Georgia, Illinois, and New Mexico; 2 each in Arkansas, Missouri, and Vermont; and 1 each in Florida, Iowa, Maine, New Hampshire, New Jersey, Oregon, South

Carolina, Texas, Virginia, and Wyoming. Fifteen of the two hundred and one certified projects had not been completed as of June 30, 1955. On a conservative basis, at prices in effect at the end of the fiscal year, the recoverable minerals and metals in the ores found on the 201 certified projects is estimated to have a gross value of approximately \$216 million. Substantial ore showings, which may lead to certification, have been disclosed on 60 other projects.

During the fiscal year 1955, 82 contracts, under which actual work was performed, were terminated without certification of discovery or development. The cost of these 82 projects was originally estimated at \$2,359,261, with Government participation set at \$1,423,-178; but the actual cost to the Government was only \$1,058,620.

Three hundred and fifteen contracts with a total project cost of \$7,743,037 had been terminated without certification at the end of the fiscal year. The Government's share in the cost of these contracts was estimated at \$4,956,968, of which only \$3,009,177 was expended. Although a few of these terminated projects have found small quantities of ore, the mineralization was not sufficient to justify their being certified. However, valuable geological information was obtained from all of these terminated projects.

Every application for an exploration project requires a study by technical experts. In the majority of cases on-site field examinations of the proposed projects are made by DMEA field teams, comprising personnel of the Geological Survey and the Bureau of Mines. Based upon the field work, a project either is approved and a contract made or the application is denied. A total of 1,206 applications have been denied—198 in the past fiscal year; and a total of 477 applications have been withdrawn—but only 64 in the past 12 months.

The number of applications received during the fiscal year 1955 increased approximately 38 percent over the number received in the previous 12-month period. This increase was primarily attributed to the marked increase in the number of applications received for uranium exploration. Substantial increases in the number of applications received for lead-zinc and mercury projects also were made, as well as smaller increases in the number received for fluorspar and mica. These increases reflect in a large degree the intense interest in uranium and the improved market conditions for other minerals.

During the fiscal year 1955 the Contract Administration and Audit Division of DMEA made rapid progress in auditing contract and ore production records. As of June 30, 1955, a total of 650 audits (covering Government disbursements of \$9,803,492) on 554 projects had been made. Of these, 175 audits were made of projects covering Government disbursements of \$2,616,542, during the past fiscal year. This Division has completed audits of approximately 77 percent of the

exploration program disbursements. In addition, 92 audits have been made on 72 projects for production purposes during the past 12 months.

In view of the increased number of applications received and resulting contracts made during the past fiscal year, DMEA increased its staff by approximately 6 percent. The Geological Survey and the Bureau of Mines made equivalent increases in their personnel assigned to DMEA work.

The DMEA issued two amendments to DMEA Order 1, amended, during the fiscal year 1955. Under date of January 12, 1955, amendment No. 1 was issued to provide for reorganization of DMEA field regions to conform with the newly established Bureau of Mines regional pattern. On March 21, 1955, amendment No. 2 was issued to change the addresses of the DMEA field offices in the new regions II and IV. The significant effect of amendment No. 2 was to move the DMEA executive officer responsible for California and Nevada from San Francisco to Reno. This change has greatly facilitated the administration of the program in that area. The DMEA also revised the consent to lien and subordination agreement forms required from owners of leased properties and mortgagors of properties that are subject to exploration contracts. These changes strengthened the administration of the program.

Although some projects are in recess status, principally to permit the operators to improve their financial positions, the number of such recessed projects is being reduced by operators restarting their projects, or, in instances where it appears unlikely that they will be able to restart within a reasonable time, by terminating the contracts.

The splendid cooperation of other Government agencies and the extensive participation of mine operators have aided materially in making the program a success. Particularly significant is the number of small operators participating in the program. Approximately one-half of the DMEA contracts call for total expenditures of \$24,000 or less and about one-third of the contracts provide for expenditures of less than \$3,000 of the operator's own funds. Substantial quantities of strategic and critical minerals have been found; and although current production, principally of ore removed during the course of the exploration work, is small, the ultimate production from successful projects will undoubtedly be important in the national economy and national defense. On some projects, currently uneconomical deposits have been found, which may be brought into production in times of emergency. These deposits constitute a reserve of strategic and critical minerals which is an important element in the Nation's mobilization base.

OFFICE OF MINERALS MOBILIZATION

Spencer S. Shannon, *Director*



ON January 6, 1955, the Secretary of the Interior established the Office of Minerals Mobilization and vested it with responsibility for carrying out the Department's mobilization functions for solid fuels and metals and minerals, except for domestic minerals exploration.

The solid fuels functions of the Office were essentially those which had been delegated by the Secretary of the Interior to the Bureau of Mines on July 1, 1954, upon the termination of the Defense Solid Fuels Administration. The functions of the Office relating to metals and minerals included those which had been delegated to the Secretary of the Interior by the Office of Defense Mobilization on November 12, 1954, although they do not include the processing of requests for accelerated tax amortization, loans, guarantees, and procurement contracts and similar operations which the Secretary had delegated to the General Services Administration on December 22, 1954.

The Director of the Office of Minerals Mobilization was appointed on May 4, 1955, and funds appropriated for the Office were to become available on July 1, 1955.

During the fiscal year, the Department's principal mobilization activities in solid fuels were devoted to attaining adequate capacity for metallurgical coal and coke. Industry applications for rapid tax amortization of production facilities were analyzed and recommendations submitted to the Office of Defense Mobilization. Coal requirements and mine capacity in Alaska received attention. A project involving reevaluation of the open expansion goals in solid fuels was initiated.

Initial emphasis in metals and minerals was on several urgent commodity problems which required prompt decision. Some of these problems involved full-scale mobilization supply-requirements analyses and broad recommendations designed to increase supply; others required a reevaluation of expansion goals or research pro-

grams; some involved recommendations on proposed government contracts.

In addition, the Office participated in policy and program developments under consideration by the Office of Defense Mobilization, in review of proposed legislation, and in mobilization exercises and activities, including Operation Alert—1955.

Emphasis was placed on organizing the Office and recruiting staff. Administrative arrangements were made with the Bureau of Mines and the Geological Survey to undertake the collection, analysis and evaluation of the technical and statistical data required by the Office.

Plans were prepared for the establishment of industry advisory committees to work with the Office in developing commodity programs and measures to assure continuity of production during emergencies.

OFFICE OF GEOGRAPHY

Meredith F. Burrill, *Director*



THE Office of Geography was established to carry out the research and other staff functions relating to the standardization of geographic names assigned to the Secretary of the Interior by the act of July 25, 1947.

The work of the Office in 1955 was mainly concerned with areas outside the continental United States. Geographic and linguistic research led to the standardization of some 200,000 geographic names for use by Federal agencies. More than 300,000 tabulating cards were punched for subsequent publication of gazetteers and about 450,000 names on maps and in texts prepared in various agencies were edited for correctness of spelling and accuracy of application. In addition, over 10,000 standard names or information about them were supplied to inquiries by telephone and mail, and research briefs were prepared for over 1,200 formal decisions.

The files now contain well over 1,000,000 names officially standardized by the Board and cross-referenced variant names. These files are substantial for nearly all foreign land areas of the world, and an increasing proportion of the work of the Office is concerned with the maintenance and supplementation of existing files, although they still do not contain all the names needed for maps on the largest scales. Domestic name standardization remained virtually at a standstill in the absence of funds for that activity.

UNITED STATES BOARD ON GEOGRAPHIC NAMES



THE Board on Geographic Names is an interdepartmental organization established by statute for the purpose of standardizing geographic nomenclature for use by the Federal Government. Its members represent the Departments of State, Army, Navy, Post Office, Interior, Agriculture, Commerce, and Air Force, and the Government Printing Office, the Library of Congress, and the Central Intelligence Agency. Dr. H. Thompson Straw, Department of the Air Force, was Chairman during the fiscal year 1955.

The Board and its committees met frequently to act on names, policies, publications, and related matters. Basic policies were formulated for new areas, and existing policies were extended and amended. The volume of activity is reflected in the Office of Geography report.

Four gazetteers of officially standardized names were issued for public sale by the Superintendent of Documents: No. 1, *British East Africa* (Kenya, Tanganyika, Uganda, and Zanzibar); No. 2, *Madagascar, Réunion, and the Comoro Islands*; No. 3, *Jordan*; and No. 4, *Bolivia*. The gazetteer of Jordan is the first publication available to the public containing standard names rendered in the Board's official system for transcribing Arabic and represents many hours of work by the Board's Advisory Committee on Arabic and Persian. This gazetteer series will cover the world, except the continental United States, at the rate of 10 to 15 volumes a year.

OFFICE OF THE ASSISTANT SECRETARY FOR PUBLIC LAND MANAGEMENT

Orme Lewis, *Assistant Secretary*



THE Assistant Secretary for Public Land Management exercised secretarial direction and supervision over the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service, the Fish and Wildlife Service and the Office of Territories.

The area administered by those five bureaus embraces more than 500 million acres of public lands in the United States, Alaska, the insular areas and the farflung Trust Territory of the Pacific Islands. Within this vast area lies the bulk of the Nation's undeveloped natural resources—its national parks and monuments; its refuges for wildlife; and multitudes of pioneering people.

In the year just past, each of the five bureaus achieved significant gains in newly broadened programs designed to promote efficient service to the public and effective conservation and development of our natural resources.

Of equal importance, was the development of forward-looking programs which assure even greater accomplishments in the year ahead.

The National Park Service, for instance, was directed to start planning a 10-year program of development and improvement to provide facilities for 80 million visitors by 1966—the golden anniversary of the establishment of the Service. Meanwhile, the Park Service, supported by congressional approval of more realistic annual budgets, made a good start toward reversing the long cycle of neglect which started with the outbreak of World War II. For the first time in many years a substantial increase in park personnel was possible and a far-reaching program of road and trail improvement could be undertaken.

The Bureau of Land Management was greatly strengthened by legislation implementing the three-point program of resource conservation and development advocated by the Department. With this new and urgently needed authority the Bureau now is in a position

to control surface use of mining claims and prevent many of the abuses of the past. At the same time, legitimate mining activities are afforded rewarding opportunities to locate and develop the underground resources the Nation must have to support its growth. Millions of acres of lands withdrawn for powersite purposes are now open to exploration under adequate conservation safeguards. Development of metal and oil and gas resources can now proceed contemporaneously on the same tract under provisions of the Multiple Mineral Development Act.

The revitalized public lands program, under which old withdrawals of public domain areas are reviewed in the light of current conditions, continued to yield substantial returns. Over 2 million acres of withdrawn lands were restored to the unreserved public domain last year. Additional millions of acres are being studied with a view toward their eventual restoration. Simplified and easily understood rules for opening restored lands to public entry were put into effect.

A further step toward more efficient land management was taken when plans were prepared for the first significant modernization of the antiquated lands record system which has been in use since before the establishment of the General Land Office in 1912.

The Bureau of Indian Affairs made praiseworthy progress in its program directed toward improving the social and economic levels of Indian citizens while consolidating its own operations into more manageable and efficient units.

Outstanding was revitalization of an educational program which for the first time promises to virtually wipe out illiteracy among the younger Indian population. By fall 1955, facilities will be available to offer schooling to virtually all school-age Indian children. A dramatic example of the accomplishments in this program is provided on the Navajo Reservation. Only 2 years ago 50 percent of the school-age Navajo children were being denied an education because school facilities were not available for them. At the beginning of the 1955 fall term facilities will be available for all Navajo children.

At the close of the fiscal year, the Bureau accomplished the transfer of its entire Indian health program to the United States Public Health Service. This represented the biggest reduction of program responsibilities in the history of the Bureau, and offers wider opportunities for improvement of Indian health.

Substantial progress was made in programs to relieve advanced Indian tribes of their wardship status and place them in a position to assume full responsibility for management of their own affairs.

Continued advances have been made by the Fish and Wildlife Service for the protection and development of the important resources entrusted to its care. Cooperation between other Federal agencies

and State and private conservation organizations was strengthened. Wildlife refuge areas were extended. Study and development of ocean fisheries were greatly bolstered by new programs made possible under the Saltonstall-Kennedy Act.

In Territorial areas, the Office of Territories continued to provide increasing opportunities for Territorial peoples to participate in representative government. Considerable disappointment, however, stemmed from the delays in securing final action on legislation for Hawaiian statehood and to advance the day when Alaska can enter the Union as a State. Programs to improve economic opportunities in the Territorial areas were broadened by legislation approved by the Congress.

BUREAU OF INDIAN AFFAIRS

Glenn L. Emmons, *Commissioner*



THE year was marked by two main developments: (1) Further progress in reducing the Bureau's program responsibilities to more manageable proportions, and (2) the greatest strides ever made by the Bureau in a single year toward its long-term goal of educational opportunities for all Indian children.

Under the first heading a tremendous forward step was taken on August 5, 1954, when legislation providing for transfer of the entire Indian health program to the United States Public Health Service was approved as Public Law 568 of the 83d Congress. Since the law established July 1, 1955, as the effective date of the transfer, a period of nearly 11 months was provided for working out details. During that time, staff members of the Bureau's Branch of Health and Administrative Division were in almost daily consultation with comparable officials of the USPHS on the innumerable questions of budget, personnel, property, and policy or regulations that were involved in the shift.

The transfer was carried out on schedule at the close of the fiscal year and represented unquestionably the biggest reduction of program responsibilities in the history of the Bureau. It included approximately 3,600 employees and a real property inventory valued at close to \$40,000,000. Among the 970 widely scattered buildings involved were 56 hospitals in 13 States and Alaska, 21 health centers, and 13 boarding school infirmaries.

Another major step toward the narrowing of Bureau responsibilities was the enactment of six laws in the 1954 congressional session providing for orderly termination of Federal property trusteeship and special services in specific tribal jurisdictions. One of these, covering the Menominee Tribe of Wisconsin, became law toward the end of the fiscal year 1954. The other five—all approved in August 1954—involved two jurisdictions in Oregon (Klamath and western Oregon), two in Utah (four small Paiute Bands and the mixed-blood population

of the Uintah and Ouray Reservation), and one in Texas (the Alabama-Coushattas).

The period of time allowed in these laws for completion of the termination process was indefinite for the Alabama-Coushattas, 2 years from the date of enactment for western Oregon and the Paiute Bands, 4 years from enactment for Klamath, until December 31, 1958, for Menominees, and 7 years from enactment for the people involved at Uintah and Ouray.

In fiscal 1955, good progress was made toward the meeting of these deadlines. Under most but not all of the laws, one of the first requirements was the compilation of an official tribal roll listing the names of all individuals entitled to an ownership interest in the tribal holdings. In each case where such a roll was required, the Indians were given the option of preparing the original roll themselves or having the job done for them by the Bureau. There was also a provision for appeals from the original roll and for final decision by the Secretary. At all jurisdictions where such rolls were required, the original compilation was completed prior to the end of the fiscal year. In only one case, Klamath, was it necessary for the Bureau to take on the compilation responsibility. This need arose after a roll submitted by the tribe was subsequently repudiated and withdrawn by the tribal enrollment committee.

All of the termination laws except the one covering the Alabama-Coushattas also authorized the initiation of special education and training programs for tribal members in need of such assistance to prepare them for the responsibilities they would have to assume after termination. Using an appropriation of \$1 million especially provided for this purpose, the Bureau made arrangements during the fiscal year with the State departments of education in Wisconsin and Oregon and with the University of Utah for carrying on such programs at all five of the affected tribal jurisdictions. The programs which were established included not only training in the English language and citizenship responsibilities conducted on the reservation but also off-reservation enrollment of qualified tribal members in selected trade or vocational schools.

The law covering the Alabama-Coushattas was different from all others since it provided not strictly for a termination of trusteeship over tribal property but rather for a transfer of the trust responsibilities from the Federal Government to the State of Texas. Although the Bureau was ready to complete the transfer in December, the action was postponed at the request of the Governor of Texas until the end of the fiscal year so the State could receive full-year compensation under a contract with the Bureau covering the public school education of Indian children. The transfer became effective by secretarial proclamation on July 1, 1955.

Substantial progress was also made during the year in transferring to the States the responsibilities for agricultural extension and home demonstration work among the Indian people. Under authority provided by the Johnson-O'Malley Act of 1936, the Bureau completed contract arrangements for the provision of such assistance by the States extension services in 11 of the 18 States where it has been conducting an extension program. Similar contracts were pending in three other States at the end of the period.

Apart from these various steps leading toward a diminution of Bureau responsibilities, the most important development of the year was a major broadening of educational opportunities for Indian children. This took place principally in the Navajo jurisdiction where nearly half of the school-age population of 27,106 was not enrolled in any school as recently as the close of the academic year 1953. Under the Navajo emergency education program, which moved into full swing in the fall of 1954, the total enrollment of Navajo children in Federal, public, and mission schools both on and off the reservation was stepped up from a level of 16,215 at the beginning of the fiscal year to 23,679 at the close. This left a balance of 5,011 unenrolled Navajos in the school-age bracket including a substantial number who were married or too old to begin school or could not feasibly attend for some other reason. Plans were developed, however, to make schooling available for all Navajo children who could attend in the fall of 1955.

NAVAJO-HOPI REHABILITATION

In its fifth year of operation, the Navajo-Hopi long-range rehabilitation program authorized by the act of April 19, 1950, produced numerous additional basic improvements for the benefit of the two aribal groups in such fields as education, conservation and survey of resources, irrigation, and road improvement.

Education

Particular emphasis was placed in fiscal 1955 on the educational phases of the program. As part of the Navajo emergency education program, construction of a new 536-pupil school on the reservation at Kayenta was started and 10 additional projects involving expansion or remodeling of existing school facilities on the reservation were undertaken.

The emergency education program required the use of dining rooms and dormitory living rooms for classroom purposes at many locations, while in some instances dormitory living rooms functioned as classrooms by day and as sleeping quarters by night. The off-reservation

boarding schools absorbed 1,200 additional students over the enrollment for the preceding year, and Haskell Institute at Lawrence, Kans., accepted a quota of special-program Navajo students for the first time.

In addition to more intensive use of existing reservation school facilities and expansion of the off-reservation program, 37 trailer schools were installed at strategic locations on the Navajo Reservation where regional population density made regular attendance feasible on a day basis. The trailer schools consists of one or more quonset huts to serve as classrooms and kitchen, and trailers which function as washroom and quarters. At many trailer school locations, development of water and access roads was necessary.

Although the 37 trailer schools had an enrollment capacity of 1,119, the average daily attendance at the close of the school year was 712.7. At some locations, the trailer schools did not prove to be feasible, and were discontinued. In other instances, a relatively low average daily attendance resulted because of lateness in completing the installation, lateness in the return of families employed off the reservation, and problems attendant upon children walking to school during the winter.

Reservation and off-reservation boarding school facilities were augmented through arrangements with six public school districts in communities located peripherally to the reservation. Through these arrangements, 1,030 Navajo children were taken into the public schools and housed in dormitories rented from private owners or constructed and operated by the Bureau. The number of Navajo students enrolled in such schools was kept sufficiently small so that they did not dominate the social pattern, on the premise that they would thus make greater use of English and be more rapidly acculturated. At two of the peripheral dormitories, the children were fed by private operators under contract arrangements.

In addition to Bureau schools and the peripheral town program, the public and parochial schools generally were highly cooperative in promoting universal education for the Navajos. Enrollment in both types of schools increased during the year. Two new public schools, constructed with funds appropriated under Public Law 815, 81st Congress, were completed on the reservation at Fort Defiance and Ganado, Ariz. At the former, 440 children were enrolled during the school year. Although the Ganado school plant was not completed early enough for use during the school year, a combined enrollment of 1,040 children at the two schools was expected in the fall of 1955.

The following tables provide statistical information with regard to the Navajo educational program:

TABLE 1.—*Summary of Navajo schools by type, enrollment, and attendance*

Type of school	Number of type	Enrollment	ADA ¹
Boarding.....	28	6,414	5,536.9
Community boarding.....	23	1,575	1,368.0
Day.....	10	622	493.8
Trailer (day).....	37	1,119	712.7
Peripheral dormitories.....	6	1,030	953.9
Hogan school (day).....	12	313	231.7
Literacy units (day) ²	6	108	52.8
Total.....	112	11,181	9,349.8

¹ Average daily attendance.² Primarily an adult program. However, in this report only children 6 through 18 are counted.TABLE 2.—*Summary of Navajo schools by classes and enrollment*

Navajo Agency, Bureau of Indian Affairs.....	11,181
Other BIA (off-reservation).....	6,882
Public (State).....	3,900
Mission (parochial).....	1,408
College and other non-BIA schools.....	308
Total.....	23,679

TABLE 3.—*Summary of enrollment and average daily attendance at the peripheral dormitory school operations*

Name of location	Enrollment	ADA	Name of location	Enrollment	ADA
Aztec, N. Mex.....	116	109.4	Snowflake, Ariz.....	120	110.6
Gallup, N. Mex.....	341	298.2	Winslow, Ariz.....	198	190.1
Holbrook, Ariz.....	129	121.7	Richfield, Utah.....	126	123.9

While construction costs of the emergency education program were met from long-range program funds, the cost of operating the 51 reservation boarding and community schools, the 6 bordertown dormitories, 10 reservation day schools, 37 trailer schools, 13 hogan schools, 6 literacy field units, and that of transporting over 6,800 children to the off-reservation boarding schools was charged to the regularly appropriated funds. The latter totaled \$8,461,165 in fiscal year 1955, and the Navajo Agency Branch of Education maintained a staff of 1,465 employees to operate the Bureau school program.

Funds requested for the fiscal year 1956 were based on census data and reflect the anticipated enrollment in the school year 1955-56, as summarized in the following table:

TABLE 4.—*Summary of anticipated enrollment in the school year 1955-56*

Type of school	1954-55 authorized (enrollment fiscal year 1955)	1955-56 enrollment anticipated by branch of education fiscal year 1955
Reservation BIA boarding schools.....	7,267	7,316
Community BIA boarding schools.....	1,406	1,575
Day schools.....	1,544	2,394
Hogan schools.....	3,373	3,350
Trailer schools.....	41,188	51,000
Peripheral or bordertown dormitories.....	960	1,295
Total.....	11,738	11,930

¹ 21 units.² 13 units.³ 14 units.⁴ 47 units.⁵ 40 units.

Health

Because of the transfer of the health operations of the Bureau to the Public Health Service, effective July 1, 1955, there was no appropriation of long-range funds for hospital and health facilities in fiscal year 1955.

Construction of the Tuba City Hospital, however, was completed during the year, and construction of housing in conjunction with the hospital began, under contract, in December 1954.

Actually, the amount of money authorized in the Long-Range Act was insufficient to carry out the total program intended, and circumstances have changed to some degree since the congressional authorization. This is especially true in connection with the treatment of tuberculosis. With the advent of the antituberculosis drugs, the construction of sanatorium facilities on the reservation or in Albuquerque is no longer necessary. It has been possible to contract for beds and medical care with nine off-reservation, privately operated sanatoria, and at the close of the fiscal year there were 480 Navajo patients in those institutions.

In addition, 100 patients were under care at the Tuberculosis Sanatorium operated by the Bureau of Indian Affairs at Fort Defiance, bringing the total to 580.

Irrigation

Work completed on the Hogback project during the year includes: (a) Construction of 8.9 miles of main canal with a capacity of 300 cubic feet per second; (b) the San Juan River siphon, 1.84 miles in length, with a capacity of 40 cubic feet per second; and (c) the placing of 2.8 miles of prefabricated canal lining.

Also in 1955, work moved forward on construction of the main canal and the subjugation of land on the Red Lake project. The main canals, distribution systems and structures to serve 900 acres of newly subjugated land were completed, the farms were assigned and were under cultivation at the close of the period. On the 300 additional acres planned for the project, subjugation was only partially complete.

Roads and Trails

The Long-Range Act authorized the construction of 636 miles of primary and 633 miles of secondary roads on the Navajo and Hopi Reservations. These mileages were considered the minimum necessary to serve schools and hospitals, and to open the reservation areas for development and trade.

In fiscal year 1955, work was completed on 33.029 miles of grade construction, 6.648 miles of base or gravel surface, 15.287 miles of bituminous surface, and 208 linear feet of bridge construction. This brought the cumulative totals under these several headings up to 162.268, 131.629, 48.260, and 996.

Soil and Moisture Conservation and Range Improvement

Conservation work carried forward under the long-range program in fiscal 1955 included 718 educational meetings with a total attendance of 13,866, new plans for over 1,000,000 acres, detailed soil surveys on almost 40,000 acres, and installation of a wide variety of practices such as contouring, check dams, cover crops, deep plowing, strip cropping, and rough tillage.

Range Water Development

Contracts were let in four districts for the drilling of 25 wells, all of which were completed, although one produced no water. In addition, contracts were let for the drilling of 21 wells with money available in the tribal appropriation. Two of these were completed by the end of the year.

PROGRAM DEVELOPMENT

One of the Bureau's most important functions during the fiscal year was to assist the tribal groups covered by termination laws in preparing for the eventual cutoff of Federal trusteeship and special services. In this connection, Bureau personnel consulted and cooperated not only with Indian groups but with State and county officials and other agencies or individuals directly concerned. In most instances, the transition requires the transfer of one or more Bureau functions to a State or local unit of government.

Since some provisions of the acts are pioneer approaches to the solution of difficult problems, differences of opinion arose here and there about their interpretation or the best procedures to follow. Most of these differences, however, were resolved by conferences of interested parties and the preliminary work leading to termination at each jurisdiction moved forward just about on schedule. The progress of each group is summarized briefly below:

The Menominees of Wisconsin on June 17, 1954, under Public Law 399, became the first group of Indians for which a bill to terminate Federal supervision over their property and affairs was enacted. The period allowed for adjustment was approximately 4 years or until

December 31, 1958. Steps taken to date include: (1) Establishment of a tribal roll, (2) distribution of per capita payments of certain funds on deposit in the Treasury of the United States with special measures taken to protect the interests of minors, (3) arrangements with the State for a special adult education program and for the transfer of education and other services to the State, (4) clarification of Bureau and tribal responsibilities under the act, and (5) the establishment of Agency offices and personnel at a site separate from those of the tribal council. This last step was taken in order to differentiate clearly between the functions and responsibilities of the tribal council and those of the Bureau during the transition period. Some of the principal remaining problems of the Menominees are those related to the management or disposition of tribal resources and enterprises and to integration with the State and county governments.

Public Law 627, approved August 23, 1954, for the Alabama and Coushatta Tribe of Texas, provided for transferring Federal trusteeship for approximately 3,100 acres of timbered tribal land to the State of Texas. This transfer, completed in less than a year, was comparatively easy because of the fact that Bureau responsibility had for a number of years been limited primarily to land trusteeship and to contract payments to the State for education of Indian children. Although Federal trusteeship responsibilities have terminated, these Indians, if they desire, will continue to be admitted to hospitals and schools maintained by the United States on the same terms as other Indians.

The Klamath Indians of Oregon under Public Law 587, approved August 13, 1954, were given 4 years to complete the transition. Their problems relate primarily to the disposition or management of tribal resources, principally timber and land. Most of the responsibility for education and other services have been carried for a number of years past by the State and local units of government. The following steps were accomplished during the fiscal year: A proposed tribal roll was submitted; payment of \$250 per capita, as required by the act, was made; a contract was entered into with the State of Oregon for a program of education and training; three management specialists were selected to assist the tribe in the management of property and in the distribution of property among adult members who may wish to withdraw their assets from the tribe; and a tribal committee was elected by referendum to represent the tribe in consultations with the management specialists.

Public Law 671 for the Uintah and Ouray Indians of Utah was approved August 27, 1954. The act contains three main features: (1) Partition and distribution of assets between mixedblood and full-blood members; (2) termination of Federal trusteeship and supervi-

sion over the property and affairs of the mixedblood group within a period of 7 years, with the opportunity for fullbloods to consider themselves as mixedbloods; and (3) a development program for the remaining fullblood group designed to assist in making them self-supporting and eventually able to dispense with Federal supervision over their affairs. Numerous consultations were held during the year by Bureau representatives with tribal members of both groups and satisfactory progress was achieved along several lines. Proposed rolls were compiled and submitted; numerous applications for transfer from fullblood to mixedblood group were received; plans for distribution of assets of the mixedblood group were prepared and submitted for review; and a preliminary draft of the fullblood long-range program was also prepared and submitted for review.

Public Law 762 for four bands of Paiute Indians of Utah was approved September 1, 1954, and provided a transition period of 2 years. During fiscal 1955, a proposed tribal roll was submitted, arrangements were made with the State University for a special program of education and training, and plans were developed for the distribution of tribal property to individual tribal members.

Public Law 588 for western Oregon Indians was approved August 13, 1954, and 2 years were allowed for the transition period. There are 60 tribes, bands, and groups included. Only two tribes—the Confederated Grande Ronde and the Confederated Siletz Tribes—owned tribal property and were required to submit tribal rolls. The proposed rolls were submitted. Arrangements were also made with the State for a special program of education and training for adult tribal members.

HEALTH ACTIVITIES

While the level of health among the Indian populations does not yet approach that enjoyed by most Americans, significant improvements in health services to these peoples were achieved by the Indian Bureau during its final year of direct administration of the Indian health program. The curative medical care program was expanded, and public health and preventive health services were intensified. These improvements were made in spite of such continuing obstacles as geographic and psychological isolation of many of the Indians concerned, shortages of medical and other health personnel, and limitations in facilities which control the extent of the services that can be rendered.

Tuberculosis continued to be the most frequent cause of severe illness and disability, followed by diarrhea and enteritis among infants and young children. Significantly, half of all deaths among Indians are caused by diseases that can be prevented—tuberculosis, pneu-

monia, influenza, and the two infant diseases already mentioned. Slightly less than half of the Indian deaths are caused by conditions which yield to modern public health measures—common communicable diseases, such as respiratory infections, and injuries.

Medical and Hospital Care

At the beginning of the year, the Bureau's Branch of Health was operating 58 hospitals for Indians, with a total of 2,840 beds. Two hospitals—one in New Mexico and one in Colorado—were closed during the year. Contractual arrangements with larger and better equipped hospitals more than offset the reduction in the number of beds due to the closing of these facilities, and will make better service available in the areas concerned.

Of the 56 hospitals in operation at the end of the year, 48 are within the continental limits of the United States, and 8 are in Alaska. There are 2,800 beds in these facilities, including 1,400 general, 1,325 tuberculosis, and 75 orthopedic. Outpatient treatments rendered through these hospitals approximated 520,800.

A substantial part of the patient care made available by the Bureau was provided through contractual arrangements with hospitals operated under State, county, community, or other non-Federal auspices. The average daily patient load in contract facilities during the fiscal year consisted of 165 general patients, 970 tuberculosis patients, and 240 psychiatric patients. The total cost of this care for the year amounted to approximately \$5.75 million.

A contract with Cornell University, under which the university supplied a surgeon and a chest specialist for the Fort Defiance Hospital, Navajo Agency, was put into effect. These two specialists provided training for physicians in various hospitals in the area by having the physicians assigned for brief periods to the Fort Defiance Hospital on a rotating basis.

Although the acute shortage of nurses continued—especially in the more remote locations—the number of nurses on duty in the Indian health program was increased during the year. This increase was made possible by reclassification of some of the positions which raised the salaries that can be paid. Anticipated improvements in housing in the remote areas were expected to alleviate the present shortage still further.

Highly qualified nurses for administrative positions in some of the larger hospitals were brought into the program during the year, and in-service training was increased to develop others for greater responsibilities.

The practical nurse school was transferred from Lawton, Okla., to Albuquerque, N. Mex., where more clinical facilities are available for

student experience. Plans were completed to use the Albuquerque Indian Sanitarium, the Santa Fe Indian Hospital, the Bureau Public Health Nursing Units, and the Navajo Medical Center for these students. Plans were approved for converting the old general hospital into a building which will house the school and provide living quarters for the students.

Tuberculosis Control

The situation with respect to the problem of tuberculosis among the Indian population improved during the year. Chemotherapy and surgery, as indicated, have done much to improve the mortality rate. Indeed, if the Indian tuberculosis patient is found early enough and if he accepts treatments, his chances for recovery are as good as those of the non-Indian.

B. C. G. vaccination is being continued on 75 to 80 percent of all newborn infants in the 26 participating Indian hospitals. The extent to which this is a factor in improving control of the disease can be better appraised if a survey can be made in several Indian schools to determine vaccination results over a 5-year period. Such a survey has been recommended.

Except in the Phoenix and Albuquerque areas, tuberculosis case-finding is being carried on by the States concerned. The mobile X-ray survey among the Hopi Indians, in which 95 percent of the recipients of treatment for tuberculosis participated, was completed recently and is being compiled. Preliminary results of the study indicates that few cases require hospitalization for active tuberculosis.

The State of Montana completed an intensive 2-year X-ray survey which, when compilation is completed, will reveal the extent of the tuberculosis problem in that State. Surveys are in process in South Dakota and Wyoming.

Public Health and Preventive Services

The program to reduce the incidence of enteric and filth-borne diseases among the Indians was strengthened and extended during the year. With the help of native sanitarian aides recruited and trained during the preceding year, intensive environmental surveys of Indian communities were instituted. These surveys were, where possible, correlated with available morbidity and mortality data for the Indian population in the areas concerned.

Concurrently, under the guidance of the area sanitary engineers, the sanitarian aides worked with tribal councils, health committees, and individual families to encourage and assist in the development of safe water supplies, proper method for disposal of human wastes and garbage, and control of insect vectors of disease.

A significant number of tribal councils responded favorably to the cooperative approach of the sanitarian aides and added their efforts to bring about improved standards of sanitation. Some of them allocated tribal funds for sanitation improvements on a community-wide basis.

Public health education work also continued to play an important part in the Bureau's disease-prevention activities. In fiscal 1955, full-time health educational activities carried out under qualified health educators were extended to two additional areas. In addition, plans for the use of Indian community workers who have received health training were put into effect on key reservations. These workers will assist in teaching measures for improving health and preventing illness.

The last fiscal year saw the inauguration of medical social services in the Health Branch on a program basis. Recruiting of medical social workers was begun, and 12 were appointed with 10 more in the process of being selected as the year ended. These medical social workers will provide direct casework services in 8 hospitals. They will concentrate on helping patients to adjust to hospital requirements and to plan for discharge and for vocational rehabilitation. They also will aid those patients who develop concern over problems relating to their illness.

EDUCATION

Approximately 113,000 Indian children of school age (6-18 years) attended public, Federal, mission, and vocational schools in the United States and Alaska in fiscal year 1955. More than half, 54.9 percent, were in public schools, 35.9 percent in Federal schools, and 9.2 percent in mission and other schools. Although enrollment in all types of schools was larger than in any previous fiscal year, the greatest increase took place in Federal schools because of the Navajo emergency education program. Percentagewise, therefore, enrollment in public schools was a somewhat smaller proportion of the total enrollment than in the previous year.

Contracts with States and local school districts under the Johnson-O'Malley Act of 1936 were negotiated in 20 States and the Territory of Alaska, providing Federal financial assistance for the public school education of more than 36,000 Indian children. In line with broad Bureau policy, the operation of Indian schools established by the Federal Government is being transferred to State and local jurisdictions wherever feasible. Public schools absorbed an additional 2,300 Indian students in fiscal year 1955.

The Bureau continued operating 86 boarding and 260 day schools in fiscal 1955. Many of the reservation boarding schools accommodate

large enrollments of day pupils. The day schools included 14 instructional aid schools in Alaska, and 53 special units (37 trailer, 12 hogan, and 4 literary) on the Navajo Reservation. Classes were also conducted for Indian children who are patients in four sanatoria, and Indian students were housed in Federal dormitories at 10 locations to attend public schools.

Approximately 83 percent of students enrolled in Federal schools were fullblood Indians and only about 3.4 percent were less than halfblood.

Navajo Emergency Education Program

This program, more fully described in an earlier section of this report, was initiated following the completion of a survey of educational needs on the Navajo Reservation in 1953. At that time, an emergency plan was developed which had as its goal the enrollment of 22,000 Navajo children in school by the fall term of 1954. As a result of special appropriations provided by Congress and close cooperation with State officials and the Navajo Indians, the Bureau not only reached but actually exceeded its goal. In summary, based on figures available at the time of the survey at the end of 1953 through to the end of the fiscal year 1955, a total of 8,914 additional children were enrolled in school. The following table shows the progress of the program by years.

	1953		1954			1955		
	6 to 18	Under 6 over 18	6 to 18	Under 6 over 18	Total increase	6 to 18	Under 6 over 18	Total increase
Enumerated.....	27, 106		27, 362			27, 752		
Enrolled.....	14, 106	659	15, 501	714	1, 450	22, 741	938	7, 464
Not enrolled.....	13, 000		11, 861			5, 011		

Plans were developed during the fiscal year for enrolling the remaining out-of-school group during the 1955 fall term. When this has been accomplished, the program will be aimed at relieving the overcrowding of approximately 2,000 pupils in present Bureau schools and providing for the anticipated annual increase in school population.

Other Educational Activities

Counseling and careful placement of Indian youth in private industry continued to receive special emphasis and to produce favorable results. In fact, some schools were unable to meet the demand for their graduates.

An evaluation team composed of four professional education employees in cooperation with school staffs evaluated several school establishments as to the programs, purposes, and needs. The team technique proved effective in focusing attention on standards in each activity and on specific planning for improvement.

While information was not available from all areas, reports received by the Bureau indicate that 21 tribal organizations have programs for assisting their youth through loans or scholarships for higher education. Montana, South Dakota, and Oklahoma have passed legislation establishing special tuition scholarships for Indian students of their respective States. In addition to funds set up by State legislatures, other sources such as youth-serving organizations of national scope, foundations, and others have increased scholarship opportunities for Indians as a result of the need presented and the cooperation offered by the Bureau.

The Bureau made grants in fiscal 1955 to 101 students attending 34 institutions of higher learning in 14 States and the Territory of Alaska.

Two areas still deserving special attention in regard to educational facilities are the State of Mississippi and the Territory of Alaska. At the Choctaw Agency in Mississippi, where the Bureau operates 8 day schools for Indian children, the facilities are far from adequate to permit the enrollment of all school-age children and have been extremely overcrowded. In fiscal 1955, a special survey was conducted of the total educational needs at Choctaw both with respect to the adequacy of facilities and the type of program offered. Based on this survey, a long-range school construction program was developed to help provide for the children out of school because of the lack of facilities and to relieve overcrowding in the existing facilities, many of which are old and in substandard condition. Under this program, four additional classrooms were provided in fiscal 1955 for use in the next school year. During the 1955-56 school year, it is anticipated that four more classrooms will be added.

In Alaska, during the year, the Bureau operated two boarding schools, 70 day schools, and 14 instructional aid schools. It also provided instruction for native children in the Mount Edgecumbe Orthopedic Hospital. In instructional aid schools, children are given instruction by local citizens in such temporary facilities as may be available. Where the population is sufficiently stabilized and enrollment justifies it, an effort is made to replace the instructional aid units with regular school facilities. Enrollment in all Bureau schools in Alaska totaled 4,897 in 1955. It was estimated that there were approximately 1,129 children, age 6 to 18, out of school during this period because of the lack of facilities. This number is believed to be made

up largely of small numbers living in isolated and almost inaccessible localities.

WELFARE

In the welfare field, increased emphasis was placed during the year on social services related more specifically toward strengthening family life and helping Indian people to improve their standard of living and to acquire self-sufficiency and independence in managing their own affairs. While assistance to needy Indians remains a basic activity of the Bureau's welfare program, there has been a growing demand for social services focused on the broader objective of preventing dependency and family disintegration and on helping Indian people to establish their legal status in matters of marriage, divorce, adoption, as well as custody and guardianship of children and adults. In the case of tribes covered by terminal legislation, this type of counseling and service is especially important to assure that children and others needing assistance will secure the protection of person and property necessary before final termination of the Secretary's trust responsibility.

Engaged in this work during the past year were 47 social workers operating in 29 of the 46 local jurisdictions of the Bureau, directed by 9 area social workers with the assistance of 5 area child welfare workers.

General Assistance

The number of cases in the Bureau's general assistance program for needy reservation Indians, who are ineligible for public assistance under the social security program, showed little change during the year. There was, however, a slight increase in the total amount of payments since individual grants were somewhat larger to reflect current living expenses.

Less need for assistance in the Northern Plains States due to a favorable, mild winter was offset by increased requests in the Southwest caused by the severe, prolonged drought, and in Alaska by the declining salmon run. During the fiscal year 1955, the general assistance caseload averaged 2,603 families and 6,799 persons monthly.

Tribal Programs

Several Indian tribes take responsibility for their own welfare programs, showing concern particularly for the old people in their groups. These programs usually include provision for general assistance to the needy tribal members. In fiscal 1955, an increasing number of

tribes became interested in the surplus food commodity program and assumed responsibility for distribution to the needy families.

Three tribal groups—Jicarilla Apache, Ute Mountain, and Southern Ute—entered into agreements with commercial banks authorized in trust management under the laws of their respective States to hold in trust and to manage the money of members of the tribes who are minors. These trust funds are established from distributions of pro rata shares of tribal collections of income from oil and gas resources.

Child Welfare

Review of the cases of children referred to Bureau boarding schools for social reasons was continued and resulted in arrangements for many of the children to remain with their own families and attend public school. On a selective basis, children without suitable homes were placed under foster care and, in some instances, better foster placements were made despite the difficulty in finding families who are willing to undertake the care of children not their own. Social workers in all areas also worked on plans for the summer care of children attending boarding schools who have no home or relatives to whom they can go during school vacation.

Contracts with the States of Minnesota, Wisconsin, and Nevada for foster care of Indian children were continued, and State legislative action made possible a limited contract with South Dakota.

Expanding health programs in Alaska and on the Navajo Reservation, together with the Navajo emergency education program, materially increased the requests for child welfare services. In addition, greater need for child welfare services was found in Montana and North Dakota due to Supreme Court decisions in both States leaving Indians outside the application of State civil law and directly affecting matters of custody and guardianship of children and facilities for their care in boarding homes and institutions.

RELOCATION

During the 1955 fiscal year, 3,461 Indians were assisted to relocate under the Bureau's voluntary relocation program. This included 2,656 persons in 708 family groups and 805 unattached men and women. The total number of relocations represents a 60-percent increase over the 2,163 reported for the previous fiscal year.

Of the 3,461 who were assisted to relocate, financial assistance to cover all or part of the costs of transportation to the place of relocation and short-term temporary subsistence at destination was provided to 2,415 Indians (including 2,033 persons in 488 family groups

and 382 unattached men and women), in addition to all other relocation services. The remainder of 1,046 (comprising 623 persons in 120 family groups and 423 unattached men and women) financed themselves but received full guidance services including assistance in obtaining employment and housing at the point of relocation.

On the reservations, there was a marked and active interest in relocation throughout the year. Available relocation assistance funds were insufficient to serve all persons who were determined to be in need and who requested relocation services. At the end of the year, a sizable backlog of applications was on hand and awaiting the availability of fiscal year 1956 funds.

During the year, field relocation office staffs were in contact with over 3,500 employers. Indians placed in various jobs earned average beginning hourly wages of \$1.62 for men and \$1.07 for women. Vital statistics among the people relocating in fiscal 1955 showed 808 school-age children relocating with their families, 96 births, and 8 deaths.

On December 27, 1954, the Branch of Relocation was assigned the responsibility for development and activation of a program of relocation combined with vocational training for members of tribes covered by enacted terminal legislation.

Contacts were made with a representative number of training institutions, and the new relocation and vocational training program was explained to them. Without exception, they indicated interest and a desire to cooperate. Agency relocation officers were assigned in Utah and Oregon, and applications were received in sufficient time so that on March 1, 1955, the first trainees and members of their families were relocated to destination points. Throughout the last third of the fiscal year, the agency relocation officers took a total of 170 applications. Of these, 113 were accepted and plans for relocation and vocational training were completed. Trainees were enrolled in 33 different courses.

LAW AND ORDER

In the field of law and order, the Bureau continued its negotiations seeking the extension of State law to Indian reservations. The act of August 15, 1953 (Public Law 280, 83d Cong.), which had excepted from State jurisdiction the Menominee Reservation in Wisconsin, was amended at the request of the Menominee Tribe to accomplish the extension of State jurisdiction to that reservation. The legislature of the State of Nevada enacted a statute pursuant to Public Law 280 for the purpose of assuming jurisdiction by the State over the Indian country therein. This statute was to become effective 90 days after July 1, 1955. The statute contains provisions

whereby any county which does not wish to assume jurisdiction may be relieved of that responsibility by proclamation of the Governor. At the end of the fiscal year, no such proclamation had been issued by the Governor.

Amendments were proposed in the Congress to Public Law 280 which would require Indian consent before the extension of State jurisdiction to any Indian reservation. The Department, however, recommended an amendment which would require consultation rather than consent. Prospects for enactment of either type of amendment at the 1955 congressional session appeared rather slim at the close of the fiscal year.

Proposals were made in the legislature of Idaho and Washington which would have provided for amendment of the constitutions of those States to enable them to acquire jurisdiction over Indian country as provided in Public Law 280. However, the proposals were dropped by the legislatures because of objections by the Indian people.

The act of May 31, 1946 (60 Stat. 229), conferred criminal jurisdiction on the State of North Dakota over the Devils Lake Reservation. However, in February of 1955, the Supreme Court of North Dakota handed down a decision holding that the purported transfer of jurisdiction was ineffective and that the State did not acquire any jurisdiction over the Devils Lake Reservation. It, therefore, became necessary for the Bureau to reassume the burden of law enforcement on the Devils Lake Reservation.

During the year, six Indian tribes adopted resolutions pursuant to the act of August 15, 1953 (Public Law 277, 83d Cong.), for the purpose of legalizing intoxicants within the reservation. This brought to 28 the total number of Indian tribal groups which have acted to exercise the local option afforded Indian groups by the provisions of the statute. Although the Indians have generally welcomed removal of discriminatory legislation outside of Indian country, they have shown a marked tendency to move slowly in the legalization of intoxicants within their reservations.

TRIBAL AFFAIRS

During the fiscal year, a new Branch of Tribal Affairs was formed in the Bureau's Washington office and placed in the Division of Community Services. The Branch took on certain functions previously performed by the coordinating staff relating to self-government, including chiefly advice and assistance to Indian tribes in connection with the development and operation of tribal business and tribal government organizations. Most of the Indian tribes operate under some form of constitution and bylaws recognized by the Department.

Many are organized as well as incorporated under the Indian Reorganization Act, the Oklahoma Indian Welfare Act, and the Alaska Act.

In fiscal 1955, many such groups found it necessary to amend their organization documents in order to bring them more in harmony with their growing activities and responsibilities, or with other changing conditions. For example, the native village of Mekoryuk in the Territory of Alaska, which consists of a group of Eskimos having a common bond of residence, enlarged its organization to include all eligible natives residing on the Nunivak Island.

Per Capita Payments

On March 13, 1953, the Assistant Secretary of the Interior stated his belief that payments of current tribal income should be made by Indian tribes on a pro rata basis to the individual tribal members with due regularity where such payments are consistent with the point of safety and the protection of the tribe as a whole. In accordance with this policy, more than \$10,084,300 was distributed through per capita payments to approximately 42,495 tribal members. The per capita shares ranged from \$50 to \$500 and four of the tribes—Uintah and Ouray, Klamath, Southern Ute, and Ute Mountain—made more than one per capita distribution during the year.

Tribal Enrollment

With the enactment of terminal legislation, the preparation of tribal membership rolls and the determination of the status of enrollees and applicants in the affected tribes became a matter of considerable importance. Generally, the legislation provided for the closing of the membership rolls as of midnight of the date of enactment and provided for preparation of a proposed roll of members of the particular tribe concerned within a specified time. If not done within that time, the Secretary was required to prepare the membership roll. The legislation required that the roll be published in the Federal Register, and thereafter, persons claiming membership in the tribe, or an interest in tribal assets, had a specified time within which to appeal to the Secretary protesting the omission from or inclusion on the roll of the name of any person. Rolls of this character were published for the Ute Indians of the Uintah and Ouray Reservation in Utah, for four scattered bands of Paiute in Utah, the Klamaths of Oregon, and the Grand Ronde Tribes of Oregon.

Legislation enacted in the 83d Congress required the Secretary to complete by June 30, 1955, the revision of the roll of the Indians of

California, which imposed a heavy burden on the Department in view of the large number of applications which had been filed. Amended regulations had to be issued, and approximately 2,000 appeals from the decision of the area director at Sacramento had to be considered by the Bureau's Washington office, with a second appeal in a number of cases to be determined by the Solicitor of the Department, acting for the Secretary. All appeals were disposed of by the June 30 deadline.

REALTY TRANSACTIONS

Over 26,000 Indian land transactions were processed during the year. Included in this total are 12,186 surface leases and 3,128 mineral leases. There were 2,594 transactions which resulted in removal of 521,771 acres from Bureau jurisdiction in response to requests from the Indian owners. This was accomplished by 1,741 sales to non-Indians and by the issuance of a total of 853 patents in fee, removals of restrictions, and certificates of competency, which transferred to the Indian applicants the responsibility for management of their trust and restricted properties. Eighty-seven tracts of land covering 10,165 acres were purchased from non-Indians for tribes and individuals.

In addition, there were 1,704 transactions completed which had no material effect on the overall acreage of land in trust or restricted status. These included sales between individual Indians, exchanges between individual Indians, sales from individuals to tribes, exchanges between individuals and tribes and conveyances of title as gifts.

The real estate sections of the Indian Affairs Manual and corresponding portions of the Code of Federal Regulations covering patents in fee, certificates of competency, removal of restrictions, and sale of allotted and purchased lands and related forms were revised during the year in order to simplify procedures, permit a wider latitude of action by the individual, and more closely align the Bureau's real estate activities with accepted commercial practices. New appraisal procedures were also adopted so that the Bureau may more effectively carry out its trust responsibilities.

As of June 30, 1955, field offices of the Bureau reported an uncompleted workload or backlog of 13,213 Indian requests or applications for various types of realty transactions. Included in this total are 1,010 requests for patents in fee, 5,681 requests for supervised sales, 593 proposed exchanges of various kinds, 154 proposed partitions, 395 requests for removal of restrictions, 126 applications for certificates of competency (which, in effect, remove the lands owned by the applicant from trust status), 1,475 proposed surface leases, 703 pro-

posed mineral leases, 392 rights-of-way actions, and 2,477 probate inventories and postings.

Mineral Leasing

Discovery of oil in the Williston Basin (which includes considerable Indian land in Montana and the Dakotas) in 1951 set off one of the greatest oil booms of recent years. The lease play (preceded by large-scale geophysical exploration) and deep test drilling necessary to prove the field, show the desirable results that can be obtained where there is competitive judgment and free investing. Not only is this true of the Williston Basin but also other areas in which there has been large-scale exploration during the past 5 years.

Not so many years ago, it was felt that operations on the Osage Reservation in Oklahoma had passed their peak. Today, however, increased interest in oil and gas operations on this reservation is an outstanding feature of the midcontinent field. During the past 5 years, the total income from bonus rentals and royalties at Osage has risen from slightly in excess of \$4,000,000 to approximately \$9,500,000.

In the southwest region, there is every indication of future record development and extension of the gasfields. A number of gas and oil wells have been brought in and the market for the gas appears assured by commencement of construction work on a pipeline from the San Juan Basin to the Pacific Northwest.

During the year, 2,997 oil and gas leases on Indian land were approved.

In the field of minerals other than oil and gas, the search for uranium is of top interest. The large number of prospectors and miners searching for uranium has presented a number of administrative problems. With a view to assisting in meeting the Nation's needs for uranium and at the same time protecting the rights of the Indians, a special procedure has been set up for the issuance of short-term prospecting permits on definitely described tracts with a right to a lease on a limited acreage.

The greatest interest centers in the Navajo Reservation, N. Mex. and Ariz., and the Pueblos in New Mexico, Wind River Reservation, Wyo., and the Spokane Reservation, Wash. The deposits in these areas are of economic importance. There is, however, widespread interest in prospecting for uranium on other Indian reservations.

The phosphate deposits on the Fort Hall Reservation, Idaho, are being explored steadily. The improvement in the lead and zinc market has proved beneficial in bringing additional royalties to the Indians of the Quapaw Reservation, Okla.

The total revenue received by Indians from bonuses, rents, and royalties on oil and gas and other mining leases during the year was more than \$29 million.

IRRIGATION

The irrigation program for the fiscal year 1955 included studies and investigation for the development and utilization of land and water resources on Indian reservations; the protection and establishment of Indian water rights; construction, extension, and rehabilitation of existing and authorized Indian irrigation projects; the study and review of operation and maintenance assessment rates on a number of projects with a view to placing the projects on a self-sustaining basis; negotiations with landowners and water users to work out plans to take over operation and maintenance work; and regular routine operation and maintenance of projects.

The determination of water rights and the construction of adequate and proper irrigation facilities for all irrigable lands on Indian reservations are the responsibilities of the Federal Government and are necessary prior to the termination of Federal trusteeship so that as many as possible of the Indian families living on reservations can obtain a sustaining economy. To this end, irrigation development work has progressed as rapidly as funds would permit.

During the fiscal year, approximately 8,300 acres of new lands were provided with irrigation facilities and by the rehabilitation of irrigation facilities approximately 10,500 acres of land were provided with a stable and supplementary water supply. The work involved drilling and equipping of 14 new wells, the rehabilitation of 35 old wells, the construction of approximately 42 miles of canals and laterals, the replacement and construction of approximately 97 various types of water control structures and the installation of approximately 77,300 feet of steel and concrete pipeline. In addition to the foregoing irrigation development work, 31 miles of power distribution lines were extended to serve an additional 218 customers on the Colorado River, Flathead, and San Carlos projects. Crops produced on the various projects during the calendar year 1954 were valued at \$50,239,000.

The more important irrigation developments during the fiscal year 1955 were on the following projects:

Colorado River project, Arizona.—During the fiscal year 1955, the work on this project included the subjugation of 2,000 acres and the construction of incidental minor structures (nearing completion); construction of 4 miles of drains; the drilling and equipping of one drainage well; and the extension of the power distribution system to provide electrical energy for 15 new customers.

No additional colonists were brought in during the fiscal year 1955 because of the indefinite status of the land tenure.

San Carlos project, Gila River Indian Reservation, Arizona.—The extreme drought conditions experienced on this project over the past several years were continued during the 1954 irrigation season. Out of a total of 100,000 acres under constructed facilities, only 45,980 acres were cropped in calendar 1954 because of the water shortage. The underground water continued to drop at an alarming rate, causing an increase in the use of electrical energy for project pumping.

The work on this project included the drilling of four new wells; replacing and lowering pump bowls in 24 wells; lowering of pump bowls in 12 wells, and the enlarging and extension of the power system to service an additional 124 customers.

California.—The work throughout the State consisted primarily of the development of water supplies for irrigation and domestic purposes on the various and scattered reservations and rancherias. The irrigation and domestic water systems on the San Manuel Reservation, Auburn, Cedarville, Laytonville, Point Arena, Robinson, Guideville, and Rohnerville Rancherias were completed and turned over to the Indians who have assumed responsibility for their operation and maintenance.

Blackfeet project, Montana.—The work on this project was the continuation of the enlargement and rehabilitation of the main canal and distribution system to provide for the delivery of a firm water supply to 21,500 acres, an increase of approximately 10,500 acres.

Flathead project, Montana.—The work on this project included the extension and rehabilitation of the irrigation distribution system to serve an additional 800 acres and the extension of the power distribution system approximately 17 miles to service additional 79 customers.

RANGE MANAGEMENT

The major problems in range management during the past year were centered in the Southwest and were of particular importance on the Navajo, United Pueblos, Fort Apache, and San Carlos jurisdictions. Continuing heavy grazing pressures accompanied by prolonged drought were largely responsible for these problems. Elsewhere, however, forage utilization on Indian lands generally has been in accord with the principles of conservation. Of the 44 million acres of Indian rangeland with a rated grazing capacity of approximately 880,000 cow-units, slightly more than 33 million acres with a capacity of about 559,000 cow-units were used by Indian livestock operators. The total use value of the grazing privileges would include approximately \$2,900,000 actually collected in cash fees and an estimated

\$3,500,000 worth of free privileges granted to Indian operators. About 80 percent of the cash collections for grazing privileges were made in Montana and South Dakota and slightly more than 70 percent of the free-use value was made available in Arizona and New Mexico.

The estimated value in the take in fish and wildlife resources is in excess of \$2,000,000.

SOIL AND MOISTURE CONSERVATION

In fiscal 1955, operators of 12,000 Indian farms and ranches comprising 26,705,959 acres participated in 221 soil conservation district programs. Many Indians are members of district boards of supervisors and take an active part in the direction of community conservation plans and work. Many Indian conservation enterprises have been formed to expedite application of works on the ground. The Navajo Tribal Council voted \$70,000 of tribal funds to assist in conservation work during the year. The Fort Apache Council voted \$60,000 and many other tribal groups came in with lesser amounts. Additional tribes begin contributions each year.

Many Indian allotments on irrigation projects have either been idle or beneficial use has not been made of the land or available water because the land had not been leveled or put into a condition to use water effectively. The land was waterlogged, alkaline, or otherwise unsuited for irrigation. The additional soil technicians made available during the year gave particular attention to the survey of such lands, and preparation of recommendations for remedial treatment. In following out these recommendations, 9,759 acres were leveled, 11,488 acres were drained, and alkali conditions were corrected on 12,069 acres bringing lands so treated into a high state of production. Lands unfit for profitable irrigation were removed from projects on the basis of these surveys and recommendations. In addition, work was accomplished on 1,067 pounds, 41,739 acres of waterspreading, 95,649 acres of reseeding, 65,065 acres of brush eradication, and attendant conservation practices. Introduction of these measures, to which the Indians contributed more than the Government, is controlling erosion, reducing flash floods and utilizing the floodwater for the production of forage and water for livestock. Livestock distribution is being improved, grazing capacity increased, and use of range facilitated by these works.

FORESTRY

About 518 million board-feet of Indian-owned timber, with a stumpage value in excess of \$8,500,000, were cut under contract or used by

Indian tribal sawmills during the calendar year 1954. An additional 130 million board-feet were cut by Indians and non-Indians for local use. As in previous years, the greatest concentration of timber sale activity was in the Pacific Northwest. The Indian forests in California, the Southwestern States, the Lake States, and Montana also contributed substantial volumes of timber to the forest products industries of their regions.

For many years the Indian Bureau has recognized the need of more dependable information regarding the quantity and quality of Indian forest resources. Recently, some tribes have made their own funds available to pay for forest inventories in order to provide this needed information. The first of these inventories to be completed was on the Navajo Reservation in the late fall of 1952. A forest management plan was prepared on the basis of this newly acquired information in April 1953 which reveals that a substantial increase in annual cut can be made without violating sustained-yield management principles. Engineering consultants, paid from tribal funds, are now engaged in a study to determine the desirable extent and direction of expansion of timber harvesting activities.

Similar aerial and ground surveys were completed during the past year on the Hoopa Valley and Tule River Reservations in California and on the San Carlos Reservation in Arizona. Forest management plans for these reservations are in preparation.

The three tribal sawmill enterprises—on the Menominee Reservation in Wisconsin, the Red Lake Reservation in Minnesota, and the Navajo Reservation in Arizona—have continued to operate successfully, doing a combined business in excess of \$3 million annually. In addition to providing a profitable outlet for forest products of the reservations, these mills provide employment opportunities for tribal members.

During the 1954 calendar year, 868 forest fires occurred on 39,439 acres of Indian forest and range land, or about 0.07 percent of the 58 million acres (including over 9 million acres of intermingled non-Indian land), requiring protection. The cost of suppression of these fires exceeded \$120,000. The number of fires for that year was 65 less than the average number for the preceding 4 years, and the suppression costs were \$62,000 less than the average for the same period. The timber, forage, and other values destroyed in calendar 1954 are estimated to be about \$160,000. Suppression costs and amount of damage were well within the acceptable limits for the year.

Less dramatic than the forest fires, but even more destructive, were the depredations by forest insects and disease. Bark beetles exacted a heavy toll from several reservation forests particularly on the Yakima Reservation in Washington, the Warm Springs Reservation in Oregon, and to a lesser extent on the Navajo Reservation in Arizona

and the Cherokee Reservation in North Carolina. Direct action against bark beetle epidemics through sanitation-salvage logging operations was undertaken on several of the reservations and a modest amount of direct control work was performed.

The principal forest diseases against which effective action was taken were the white pine blister rust, in the Lake States, and the dwarf mistletoe on the Mescalero Reservation in New Mexico.

EXTENSION ACTIVITIES

As indicated earlier, responsibility for extension work among Indians was taken over during the year, under contract arrangements, in 11 of the 18 States where the Bureau has had an extension program. Greater emphasis was also placed on the education phases of the Bureau's extension program and on bringing Bureau methods and procedures more in line with those used by the State extension services. In this connection, the Bureau adopted for the use of its extension workers, in the respective States in which they are workers, the same forms for building Indian extension programs and reporting the work as the State extension workers used in making their programs and reporting their work. The change in the use of forms is helping and simplifying the transfer of the Bureau's extension work to the various States.

In calendar 1954, Bureau extension workers made 48,601 farm and home visits, received 53,490 office calls and held or participated in 3,916 meetings for adults with an attendance of 165,380.

In promoting crop improvement work, extension agents assisted some 20,000 individuals to adopt better farm practices with reference to improved varieties, soil culture, use of fertilizers, planting, harvesting, irrigating, control of injurious insects and plant diseases and better farm planning.

Livestock production, especially beef cattle, is the Indians' largest single agricultural enterprise. The progress Indians have made in the improvement of their livestock has been outstanding and has contributed very greatly to their agricultural income. Extension workers assisted approximately 21,000 farmers and stockmen during the year in the improvement of their livestock production and management practices, such as selection and breeding, feeding, marketing, control of livestock diseases and parasites, and the use of more efficient business methods.

Home Extension Work

Bureau home agents gave assistance to families in the construction or remodeling of 851 homes; in providing household furnishings for

802; in selection, use and care of home equipment for 1,092; in providing water and/or sewage systems for 579. In planning and producing the home food supply, assistance was given to 2,180 families, and 3,710 were assisted with meal planning preparation, preservation and storage of food, with special emphasis on child feeding. Clothing construction work was done with 7,414 families and 3,413 were aided in selection, buying, and mending of clothing. Safety, first aid, and sanitation practices were conducted with 2,729 families. Family and community recreation and development were stressed.

4-H Club Work

During 1955, Bureau Extension personnel sponsored 289 4-H Clubs with a membership of 3,450 enrolled in projects approved by the respective States. Bureau agents reported 395 members having health examinations because of participation in the extension program. Indian youths participated in fairs, tours, county and State contests with 378 attending a 4-H Club camp and 369 engaging in community activities.

ROADS

The Federal-Aid Highway Act of 1954 provided contract authorization in the amount of \$10,000,000 for construction and maintenance of Indian reservation roads and bridges for each of the fiscal years 1955, 1956, and 1957. The authorization made it possible to speed up construction work on most reservations and also to develop realistic long-range plans of operations and to integrate those plans with the long-range plans of the local governments.

The road construction program on the Navajo and Hopi Reservations amounted to \$2,592,000 for the construction of part of the system of roads authorized by the Navajo-Hopi Rehabilitation Act. The Bureau total road construction program consisted of \$7,956,672 allotted to 9 areas serving 24 States. Two hundred and sixty-four miles of reservation road were graded and drained; 349 miles were surfaced; and 950 running feet of bridges were constructed. One hundred and seventy-two miles of road were constructed and removed from the Indian Bureau system under agreements with counties whereby the Bureau agreed to construct the roads according to a specified standard and the counties agreed to include the constructed mileage in their local highway systems and to assume full maintenance responsibility.

The Bureau's road maintenance program in fiscal 1955 included surface maintenance, snow removal, flood damage repairs, and repairs to bridges on 18,446 miles of Bureau roads.

CREDIT ACTIVITIES

The Bureau continues to maintain a credit program for the benefit of those Indians who are unable, because of lack of acceptable collateral or for some other reason, to obtain financing from the same sources as other citizens. At the same time, however, Indians are being increasingly encouraged to seek their needed financing from these normal sources and Bureau credit employees actively assist them in doing so.

Since many Indians now deal directly with lenders without benefit of Bureau assistance, full information on the amount of financing received by Indians from non-Bureau sources is not readily available. However, incomplete data indicate that the amount of financing they receive through regular commercial channels is steadily increasing and that dependence on the Bureau for financing is thus being reduced. The following tabulation shows available data for recent years:

	Financing from commercial sources (calen- dar year)	Additional loans by the United States (fiscal year)
1952.....	\$22,316,000	\$2,463,836
1953.....	27,665,000	1,075,755
1954.....	33,959,000	453,322

The Bureau's credit program is conducted mainly with two funds—tribal moneys and a revolving loan fund appropriated by the Congress. Tribes with funds available are required to use their own moneys to supply credit to their members. Tribes that do not have funds available, or whose funds are insufficient to take care of the credit needs of their members, may receive loans from the United States.

At the close of the 1954 fiscal year, the amount of tribal funds being used for credit purposes exceeded the amount of loans outstanding by the United States for the first time in the history of the Bureau's credit program.

	Tribal funds used for credit purposes	Revolving loan funds borrowed from the United States
1952.....	\$8,537,445	\$11,335,261
1953.....	9,704,611	10,190,941
1954.....	9,669,463	9,505,193

In 1952, Indians were using for credit purposes about 75 cents of tribal funds for every dollar borrowed from the United States. By 1953, the amount had increased to 95 cents for every dollar, and by 1954 to \$1.02.

Revolving Loan Fund

Through the 1954 fiscal year, \$13,799,600 had been appropriated for the revolving loan fund out of authorizations totaling \$17 million. No additional appropriations were made in either 1954 or 1955. Of the amount appropriated, \$12,550,768 was available for loans. Repayments of principal and interest payments on loans are credited to the fund, and are available for further loans. A further source of revenue to the fund is cash received from livestock sales and settlements pursuant to the act of May 24, 1950 (25 U. S. C. 443).

The following tabulation summarizes operations under the revolving loan fund through the fiscal year 1954:

Receipts:

Appropriation available for loans.....	\$12, 550, 768
Interest paid.....	915, 954
Cash settlements for cattle.....	1, 341, 232
Repayments on loans.....	13, 586, 132
Total.....	28, 394, 086

Expenditures:

Total loans made.....	23, 114, 070
Cash balance June 30, 1954.....	5, 280, 016

Loans receivable:

Total loans made June 30, 1953.....	\$22, 660, 748
Additional loans 1954.....	453, 322
Total loans made.....	23, 114, 070
Less:	
Payments made to June 30, 1953.....	12, 464, 169
Additional payments 1954.....	1, 121, 963
Total payments.....	13, 586, 132
Cancelled to June 30, 1953.....	5, 582
Additional cancellations 1954.....	17, 163
Total.....	22, 745

Loans receivable June 30, 1954.....	9, 505, 193
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The collectibility of some of the outstanding loans is questionable. Loans in Alaska accounted for \$4,432,521 or about 47 percent of the unpaid balance, and this record was largely attributable to recent poor fishing seasons in southeast Alaska. Four Alaskan villages that

received loans for the acquisition and operation of salmon canneries suffered substantial losses in 1953. They were indebted for loans totaling \$3,589,122 as of June 30, 1954. Only one village has any equity remaining in its cannery. The other three villages have sizable deficiencies, and the loans made by the United States to them are endangered. It was necessary to restrict activities of these canneries during 1954 because of the critical condition of the outstanding loans. An unpaid balance of \$237,717 also remained on loans made to five other villages in southeast Alaska, on which substantial losses may be suffered. The remaining \$605,682 owed on loans made in Alaska was, in the main, collectible.

A reserve of \$1,105,575 was established for loans of doubtful collectibility as of June 30, 1954. The revolving loan fund had a deficiency of \$173,553.

Use of Funds by Tribal Organizations

Loans of revolving funds by the United States to Indian tribal organizations, and tribal funds advanced to such organizations for credit purposes, are used to finance tribal enterprises, and to make loans to individual members and cooperative associations of members. Repayments of principal and interest collected on such loans are available for further loans within the terms of the organizations' agreements with the United States.

The following table shows the total credit operations of tribal organizations and the volume of business during 1954:

	Advances to enterprises	Loans to co-operatives	Loans to individuals	Total
Loaned or advanced to June 30, 1953.....	\$16,183,415	\$1,344,813	\$27,477,229	\$45,005,457
Additional 1954.....	336,853	25,937	1,973,123	2,335,913
Total to June 30, 1954.....	16,520,268	1,370,750	29,450,352	47,341,370
Repaid to June 30, 1953.....	7,145,692	1,181,264	18,449,633	26,776,589
Additional 1954.....	449,448	26,132	2,208,121	2,683,701
Total to June 30, 1954.....	7,595,140	1,207,396	20,657,754	29,460,290
Canceled to June 30, 1953.....	11,401	13,576	166,375	191,352
Additional 1954.....		13,128	63,397	76,525
Total to June 30, 1954.....	11,401	26,704	229,772	267,877
Balance unpaid June 30, 1953.....	9,026,322	149,974	8,861,220	18,037,516
Balance unpaid June 30, 1954.....	8,913,727	136,650	8,562,826	17,613,203
Decrease.....	112,595	13,324	298,394	424,313

Tribal enterprises are operated by organizations for the benefit of all members of the tribe conducting the enterprise. The Alaska salmon canneries, Eskimo trading posts, stores, tourist courts, live-

stock herds, farms, and land enterprises are examples of the types of enterprises conducted. Cooperative associations differ from tribal enterprises in that membership is restricted to those Indians interested and engaged in a particular activity and does not comprise the whole tribal group. Livestock associations constitute the main type of cooperative undertaking. Generally, the livestock are individually owned, but are operated cooperatively.

There were 5,835 loans to individuals outstanding as of June 30, 1954, a decrease of 454 from the number outstanding the year previous. The repayment record was not satisfactory. Delinquencies increased from 5.20 percent of the amount due at the close of 1953 to 6.35 percent at the close of 1954. Over 33 percent of the total amount delinquent was on loans made in Alaska. Because of the high delinquency rate, it was necessary to restrict the credit activities of some Indian organizations.

BUILDINGS AND UTILITIES

Construction activities of the Bureau in the 1955 fiscal year were primarily concerned with completion of the Navajo emergency education program started in the latter part of the previous fiscal year. These completed facilities provided educational opportunities for an additional 3,384 Indian children. By using economical materials and methods of construction, a saving of \$887,334 was made in the "NEEP" program. This saving was reprogramed to provide additional facilities, and this work was well under way at the close of the fiscal year.

A complete new school at Kayenta, Ariz., on the Navajo Reservation, was nearing completion at a cost of \$1,086,000. The project includes an 18-classroom school building, two 268-pupil dormitories, dining hall and kitchen facilities, 42 quarters for educational personnel, and utilities for the new plant.

Major educational facilities provided in other areas included a dining hall and quarters at Warm Springs, Oreg., at a cost of \$59,500; school building, gymnasium, dining and kitchen facilities and 12 quarters at Neopit, Wis., on the Menominee Reservation at a cost of \$257,835 (tribal funds); and a heating system at Keams Canyon, Ariz., on the Hopi Reservation at a cost of \$137,980.

In addition to sanitary facilities provided in the Navajo program, sanitary conditions were improved in nine other locations at a cost of \$338,292.

One 75-bed hospital was completed at Tuba City, Ariz., on the Navajo Reservation at a construction cost of \$680,125. Fifteen quarters were constructed at Tuba City and the old hospital was remodeled to provide 15 additional quarters for hospital personnel, at a cost of

\$218,886. The Bureau also remodeled and enlarged the hospital at Keshena, Wis., on the Menominee Reservation, to provide a 34-bed hospital. This project was financed by tribal funds. Health facilities on the Papago Reservation were increased by the construction of a clinic and a quarters building at Sells, Ariz., costing \$34,874.

ARTS AND CRAFTS

The Indian Arts and Crafts Board continued to promote the economic welfare of Indian artists and craftsmen through a threefold program focused on educating the Indian craftsmen in modern commercial methods, fostering high-quality Indian products, and protecting both the consumer and the Indian producer from cheaply imitated wares.

While the individualism of the Indian craftsmen has been a major asset in production, it has been of little help in the marketing of their products. Originality of design and execution give Indian arts and handicrafts their charm; but in selling goods, the craftsmen need group action and technical assistance in promotion, production, marketing, and developing their own business organizations.

One of the principal functions of the Indian Arts and Crafts Board has been to encourage the formation of strong Indian-owned and Indian-operated production-sales organizations through which the Indians are taught modern merchandising methods without "commercializing" their products.

In calendar 1954, the Qualla Arts and Crafts Association at Cherokee, N. C., with the Board's assistance, achieved a noteworthy record. By producing only the highest quality and selling exclusively the finest workmanship of the Cherokee craftsmen, this organization had total sales amounting to \$35,602.08 for the period. It is sponsored by the board which maintains in residence at Cherokee an arts and crafts specialist who gives firsthand assistance in maintaining standards, in improving production and sales techniques, in promotion, and in organizational matters. With this technical guidance, a State charter was applied for and granted to the organization in 1954, making it a cooperative venture, entirely self-owned and economically independent.

Similarly, the Rosebud Arts and Crafts Association in South Dakota, with the assistance of the board's regional representative, became a State-chartered cooperative. Plans are now under way to activate a similar sales and production organization for the Southern Plains Indians.

The Board through its staff of five regional arts and crafts specialists sponsors 18 organized Indian crafts groups and many hundreds of

individuals in the United States and Alaska, providing field assistance to each through the comparatively small staff. Specific areas of operation for the Board include Alaska, the Northern and Southern Plains States, North Carolina, Florida, Mississippi, and the Southwestern States. Total sales of the combined craft groups in calendar 1954 amounted to \$451,005.44 as compared with \$396,226.32 the preceding year.

Although the Board has accurate records only on sales made within the scope of its operations, it estimates that approximately \$6 million worth of Indian arts and crafts altogether were sold in the United States during 1954. This is a substantial economic factor and an indication of the effectiveness of the Board's overall program during the past 17 years to create better public recognition of the work of Indian artists and craftsmen in the United States and Alaska.

PROPERTY AND SUPPLY

The continuing study of Bureau operations that may be in competition with private enterprise resulted during fiscal 1955 in the closing out of more laundries, dairies, telephone and power systems. The services are now obtained commercially.

Fourteen Federal Indian schools were transferred to public school districts, and several others were in process of transfer under the act of June 4, 1953, at the close of the fiscal year.

The job of reevaluating Government quarters occupied by Bureau employees at field installations was completed and new rental rates were established in accordance with directives of the Bureau of the Budget.

A real property inventory was initiated in order to put the records of all federally owned real property in the custody of the Bureau on a current basis. These records, when completed, will provide data for reporting to Congress as well as for administrative use.

BUDGET AND FINANCE

Continued progress was made during 1955 in revising and improving the accounting system installed in bureau accounting offices in fiscal 1953, particularly in the revision of certain operating and other accounts to more adequately meet budgetary and program needs. In order to carry out the work of the Bureau more adequately and efficiently, certain housekeeping functions of the area offices at Anadarko and Muskogee, Okla., were consolidated at Muskogee, resulting in the discontinuance of the Anadarko accounting office. Accounting and

related work for the Flathead irrigation project in Montana were transferred from the Billings area office to the Flathead project, and a separate accounting office was established at Albuquerque to perform the accounting and related functions in connection with the construction of specific buildings and utilities projects. In addition, the accounting functions for the Cherokee Agency, North Carolina, were transferred from the Aberdeen area office to the central office to coincide with the responsibility for the Cherokee programs. Studies were continued to further improve, strengthen, and simplify budgetary and accounting requirements.

ORGANIZATIONAL CHANGES

The relocation office of Oakland, Calif., was moved during the year to San Francisco, and two suboffices were established—one at Oakland and one at San Jose. This new arrangement should enable the Bureau to provide better service for Indians relocating in the bay area.

Consolidation of the overall direction of programs and the house-keeping functions of the Red Lake and the Consolidated Chippewa Agencies of Minnesota in a new headquarters at Bemidji was made during the year. It is expected to bring about a substantial saving in operating expenses.

The Cherokee Agency in North Carolina was placed directly under the central office for reporting purposes instead of clearing through the Minneapolis area office. The agency location in relation to the central office in Washington facilitates communication and overall supervision.

The construction of the Fort Randall Reservoir in South Dakota made it necessary to abandon the site where the Crow Creek Agency was located. The agency was moved to the Pierre Indian School at Pierre, S. Dak. The name has been changed to the Pierre Agency.

PERSONNEL

The Bureau established an executive development program designed to provide a fully rounded administrative background to Bureau field and Washington office employees who have demonstrated their ability to assume higher administrative responsibilities and who possess administrative potential. Employees included in the program are selected from the substantive program activity functions as well as the general administrative functions and are presently occupying positions at the GS-9 through GS-13 levels. The program is considered by the Civil Service Commission to be one of the broadest and most progressive ever approved by the Commission, covering both administrative and program officials.

BUREAU OF LAND MANAGEMENT

Edward Woozley, *Director*



PUBLIC LANDS

THE Department's responsibility for stewardship of the public domain has evolved from an 1812 Congressional charge to the General Land Office: “* * * to perform all actions and things touching or respecting the public lands of the United States * * *.”

Since 1946 when the General Land Office was consolidated with the Grazing Service, that responsibility has centered in the Bureau of Land Management which administers or participates in administering the vast residue of public domain and certain other lands—an area totaling some 826 million acres in the United States and Alaska.

The Bureau exclusively administers approximately 468 million acres of this total, most of which is unappropriated and unreserved. About 178 million acres lie in the United States, 290 million in Alaska.

In addition the Bureau has secondary responsibilities of varying degree in disposing of the natural resources in another 242 million acres reserved for national forests, national parks, national monuments, wildlife refuges, historic sites, irrigation projects, military or atomic energy use, power sites, and other public purposes; 58 million acres of privately owned lands in which the minerals are reserved to the United States; and 58 million acres of acquired lands—most of which was once part of the more than 1 billion acres that have been disposed of under the numerous public land laws since the founding of the Nation, but which have reverted to Federal ownership through purchase, exchange, transfer, condemnation, or donation.

Functionally, the Bureau of Land Management deals with the natural resources of the public domain. These are the land itself, the range grasses and other forage, the minerals (including oil and gas) and millions of acres of forest and woodland.

With respect to the land, the Bureau surveys, diagrams, plats, registers, transfers, patents, reserves for special purposes, classifies,

sells, and leases the public land in multifarious ways—and maintains the vast official record of all such transactions, including more than 6 million patents contained in nearly 12,000 volumes. These records are the original links in the chains of title to real estate actions both private and Federal.

In the production of forage for livestock and wildlife on the Federal range, the Bureau protects, restores, conserves, improves, and leases some 170 million acres of unreserved lands for grazing, browsing, and other purposes.

BLM acts as custodian of minerals in the public domain (including reserved lands), in acquired lands, in 58 million acres of privately owned lands in which the minerals are reserved to the Federal government, and in a recently added new frontier—the submerged lands of the Outer Continental Shelf. The Bureau is responsible for administering the thousands of complex laws governing mining and mineral leasing.

The Bureau of Land Management manages the forests of the public domain and O. and C. reverted lands of western Oregon for maximum sustained yields and sells these yields on a free competitive basis to private industry.

REORGANIZATION COMPLETED

Followthrough on the reorganization which was placed in effect during the previous fiscal year required considerable personnel management activity in redescribing positions, duties and performance standards in the training of supervisors and indoctrination of employees to different supervision, and in new and changed work procedures, in staff shifts to effect improved placements and in adjusting the staff in general to work operations in the changed organizational units.

In general, employee productivity and quality of work was maintained after due allowance for reasonable obstacles inherent in such a reorganization. The leadership ability demonstrated by the principal new crop of management officials, namely State supervisors, was significant during the first full year of operations.

On May 1, 1955, the Bureau installed a promotion plan designed to insure selection of the best available person for a given vacancy. The plan provides for formal consideration of all persons within the Bureau who meet minimum basic qualification standards for the job and, in addition, requires consideration of qualified applicants from outside.

With exception of one area administrator and one State supervisor the management staff of the Bureau remained intact throughout the year.

The sixth annual BLM training conference was held in August at the Tony Grove summer camp of the Utah Agricultural College near Logan, Utah. Forty selected Bureau employees, representatives of the Department, the college, the Congress, the Forest Service and other Government agencies participated in the program.

Five management trainees, representing each area and the Washington Office, participated in the Department's sixth management training program in Washington.

Employment in the Bureau on June 30 totaled 1,889 distributed as follows: Area 1, 461; Area 2, 554; Area 3, 480; Area 4, 169; Eastern States office, 92; and Washington office, 133.

MANAGEMENT PLANNING

With reorganization of the Bureau essentially completed and issuance of manualized procedural instruction well under way, the urgent necessity for modernizing the Federal Government's public land records was the biggest single improvement problem confronting BLM in fiscal year 1955. The Bureau met it head-on by laying the groundwork for a two-phase modernization program that will be the first innovation in an antiquated records system predating establishment of the General Land Office in 1812.

The first step, planned for completion by the end of fiscal year 1956, calls for the preparation of a control document index at a cost of \$400,000, which amount was made available by Congress. The control document index will consist of microfilm copies of patents, orders of withdrawal and restoration, and other essential records mounted on aperture-cut tabulating cards.

The second step calls for the total revision of the basic land records over a 5-year period at an estimated cost of \$5 million for the 17 Western States. The second step will be accomplished progressively on a State-by-State basis, and upon completion of the records for a State, the basic land records and the portion of the control documents index pertinent thereto will be completely decentralized to the field office concerned.

Under the new system, the present status record will be replaced by a two-part record developed with modern methods, techniques, and equipment, and using simplified procedures. The first part of the record is a narrative summary, chronologically arranged, of all essential actions and transactions affecting a single township. The second part is a township status plat which will show graphically the ownership status of lands and minerals at a glance.

Benefits to the Bureau, the whole Federal Government, and to all users of the public land records will be fourfold: The official record

of the public domain will be complete; lands conveyed, rights granted, and rights retained will be known; determination of land ownership and use status will be simplified; applications of all kinds can be handled more effectively, easily, and economically.

The Bureau also developed a completely new program planning system aimed at providing a more realistic basis for budget making and work accomplishment. Applied for the first time to the work program and proposed budget for fiscal year 1957, the new system establishes an up-the-line responsibility for proposing a program, based on the needs of all operating levels, and a down-the-line allotment of funds based on programs authorized. Besides providing incentive to accomplishment, the new program will afford a supervisory check of progress made with funds authorized.

FINANCE

Revenue from the management of public lands in fiscal year 1955 amounted to \$239,548,730. This amount included some \$142 million from the initial "sale" of leases on the Outer Continental Shelf and \$97 million from public land receipts, an increase of \$20 million over the prior fiscal year. Of the total amount, over \$38 million was distributed to States and counties. The receipts were from varied sources, principally from oil and gas leasing, timber and land sales and grazing permits and licenses.

The Bureau's appropriation for expenditure in fiscal year 1955 amounted to \$15,451,574.

LANDS

The departmental and Bureau program to revoke unnecessary withdrawals of lands reserved for various purposes yielded increased results during the year with restoration of a total of 2,044,000 acres of public land. Approximately 1 million acres of the released lands are in Alaska. Additional millions are now in various stages of processing preparatory to their release. Withdrawals totalled 1,238,000 acres. The major portion of this area (almost 900,000 acres) is accounted for by the Craters of the Moon and Saylor Creek gunnery ranges in Idaho, set aside for the Air Force. Withdrawals of lands within national forests as forest administrative, recreational, and related sites constituted an additional 121,000 acres to the total. Otherwise, withdrawals were held to relatively small areas. Genuine need of the land for public purposes had to be demonstrated in all cases as a criterion for granting any withdrawals.

A simplified format for opening public lands to entry upon revocation of a withdrawal, or otherwise, was approved and put into effect.

The new language informs the public precisely when they may apply under the nonmineral land and under mineral-leasing laws, when they may make mining locations, and at what time their applications will be considered as filed. The form calls for actual dates rather than computation of dates when the various provisions of the order will take effect. The purpose of this is to inform the public specifically as to their rights and to avoid confusion and conflict, particularly in connection with mining claims.

New rules were also issued to insure greater publicity concerning applications for the withdrawal of public lands. In addition to publication of notice of such applications, local press information must be issued, individual notification must be given to those who have a record interest in the lands, and copies of the notice must be posted in the land and district offices of the Bureau and sent to the country recorder, the local post office, courthouse, and other locations generally frequented by the public. These procedures have been adopted to give the interested public full opportunity to be heard in connection with proposed withdrawals.

The Bureau cooperated in the intense search for uranium by expediting action on restoration of lands, wherever feasible, to mining location. This program was not without its problems. An area in the Pumpkin Buttes section of Wyoming, which included 7,520 acres of public lands and 38,920 acres of patented lands where the minerals had been reserved to the United States, was released from an Atomic Energy Commission withdrawal after an earlier revocation had been itself revoked due to the probability that violence might break out at the date set for the making of mining locations on the lands. The second order of opening, which was preceded by considerable publicity, went into effect without indication of adverse results.

As part of the program to cooperate with the States to assist and encourage them to seek satisfaction of their land grants, a number of Executive orders dating back to 1910 withdrawing the leasable mineral deposits in the public lands in Utah were modified to permit the grant made to the State for school purposes to attach.

Efforts to reduce the backlog of pending withdrawals and restorations met with some measure of success during the year. New applications and relinquishments were considerable but these, in the main, were kept current.

Land Adjudication

Land use and disposal applications continued to be received at an accelerated pace. New and reactivated cases were approximately 60 percent higher in number than in the preceding year, which in turn had set a record for the period since World War II.

Chief source of the higher-rate-of-applications experience was the mounting demand for public lands of 5 acres or less under the Small Tract Act. This demand was highest in southern California and southern Nevada where "land locator" or "filing service" operators were extremely active. Small tract base applications were up approximately 50 percent from a year earlier, and applications for small-tract option purchases more than doubled the rate of the preceding year. In addition, a few direct-auction sales of small tracts were held during the year.

Applications for other types of land disposals or permitted uses continued at a fairly steady pace, except for substantial increases in the volume of desert-land applications, State indemnity selections, and public land withdrawals and restorations. Large increases occurred in reactivations of homestead and desert-land entry cases, reflected in final proofs filed by entrymen on entries that had been allowed in increasing numbers in recent years.

The number of land adjudication cases completed during the year nearly doubled the 1954 output and the improvement extended to all types of cases. The unrelenting influx of new work, however, once again defied all efforts to make inroads into the backlog of pending work. This has been the annual experience of the Bureau since the beginning of the Korean conflict.

An important development pertaining to desert-land entries was the issuance of Opinion M-36263 by the Solicitor of the Department of the Interior on February 23, 1955. This opinion held that desert-land applications cannot be allowed and that desert-land entries cannot be patented where the source of water alleged is percolating ground water within the State of Arizona. The reason given was that under the decision of the Arizona Supreme Court in the case of *Bristor v. Cheatham* (75 Ariz. 227; 225 P. 2d 173, 1953), percolating waters not comprising an underground stream with well-defined channel and banks and a current are not subject to use under the appropriation doctrine.

Misleading advertising by land-locating agencies, particularly in California and Nevada, unintentionally or otherwise caused numerous individuals during the year to believe that by merely paying a filing fee they automatically gained title to 5 acres of desirable public lands near established communities with excellent opportunity for development, including roads, streets, water, electricity, and schools, and other public services or utilities. The speculative resale value of such tracts was emphasized by some of the locator services. To insure personal knowledge by the applicant of the topography and other features of the land, a regulation was issued on June 28, 1955, effective July 5, 1955, by which personal inspection of the tract applied for,

or land within one mile of the tract, was required of all small-tract lease applicants.

Land Classification

The public domain land classification program of the Department has been decentralized to the field offices of the Bureau of Land Management. Land classification pursuant to section 7 of the Taylor Grazing Act or other laws is essential before disposal or occupation of public lands may be made under homestead, desert land, public sale, exchange, or selection applications, and certain other applications. Allowance of applications is discretionary.

Of significance during the year was the issuance by the Director of the Bureau of Land Management, after review by the Office of the Secretary, of policy directives controlling the conditions under which lands will be classified as suitable or not suitable for disposal under the Desert Land Act and State indemnity selections.

The desert-land policy is to encourage development of suitable agricultural lands by private enterprise, consistent with the intent of the Desert Land Act and the Taylor Grazing Act. Development must be based upon a determination as to the highest and best use of the land. Land classified for disposal under the Desert Land Act must be, among other things, more valuable or suitable for the production of agricultural crops under irrigation than for the production of native grasses and forage plants.

The classification policy for State indemnity selections is to give a high priority to the satisfaction of State selection rights. Such selections will be approved unless, in accordance with prescribed criteria, they conflict with applications previously filed, with small-tract or recreational classifications, or with an active Federal management program, or they involve lands necessary to the effective management of other Federal lands.

The conduct of land classification investigations on an area basis as distinguished from individual applications, is one of the Bureau's management improvement projects. The major objective of area classification is economy in operation through the consideration of all land-use factors affecting an entire geographical unit, such as a small subbasin. The overall approach permits assessment of all values and results in obtaining information necessary or action on all types of applications on hand or when received.

Smaller area classification projects are not limited to areas where disposals are being considered under the Small Tract Act. Area classification also applies where groups of tracts can be examined simultaneously pursuant to applications for homesteads, desert land entries, State lieu selections, public sale, or other forms of disposal.

Such projects are also initiated on the Governmen's motion, such as public sale disposal areas or to determine the classification of a range area that has been proposed for reseeding.

Most area classification work of the Bureau, owing to the great influx of applications, is done in response to the demand for land from applicants. In addition, however, the Bureau has continued its participation in the interagency public land inventory and classification program in the Missouri River Basin and completed its classification work in the Arkansas-White-Red River drainage area.

In the Missouri River Basin, a total of 12,501,217 acres of public lands and interspersed patented lands have been classified to date. Of this total 855,328 acres were classified during the current fiscal year. As a result, several land disposal areas have been delineated. A Bureau program of land disposal on its own motion was initiated in South Dakota with the public auction sale in June 1955 of 74 tracts totaling 11,000 acres in Haakon County. Major land pattern adjustments are underway for the simplification of control of lands among Federal and State agencies. Important data for land treatment measures in connection with range improvement and resource conservation are also being obtained.

Land classification studies in the Arkansas-White-Red River Basin resulted in the revocation of a withdrawal of 112,000 acres of principally woodland in Arkansas. The public lands involved are being systematically disposed of at public auction sale.

Area classifications were completed in a number of other instances, allowing decisions to be made on groups of individual applications affected thereby. The following examples indicate the kinds of issues that were involved in typical area classification projects.

On the basis of the Mojave Drainage Report involving 101,280 acres of desert land in Southern California, action was taken on 354 applications for desert-land entry. Of these, 185 applications covering 47,000 acres were found to be suitable for entry and 169 applications covering 54,280 acres were found to be unsuitable and were rejected.

An area of 150,000 acres of vacant public lands in Okanogan, Ferry, and Stevens Counties, Wash., was classified for State lieu selection and 20,000 acres in Benton County, Wash., were classified for disposal by public sale.

In the Amargosa Desert area, Nye County, Nev., 91,000 acres of vacant public lands were examined in connection with 37 pending applications for permits under the act of October 22, 1919.

Thousands of small tract applications have been filed in the vicinity of Las Vegas, Nev. Classification action for small tract uses in this area have been delayed by the attention that necessarily must be given to competing applications for desert-land entries, exchanges, other forms of disposal, including unpatented mining claims. A total

of 33,140 acres of land in the Las Vegas vicinity was classified for disposal under the small tract program during the year.

Butler Valley in northeast Yuma County, Ariz., involving 103,730 acres of vacant public lands, was examined for suitability for agricultural entry in response to 41 applications for desert-land entry. The study resulted in the rejection of all applications.

Lands Legislation

The existing body of public land laws relating to the disposal of public lands is a maze of separately enacted laws dating back more than 100 years and amended numerous times to reflect changing conditions and special situations. As a result, there is embodied in them a lack of uniformity, some inconsistencies and conflicts and numerous obsolete procedures. In addition, some of these obsolete laws are not consistent with modern-day operations of the executive branch of the Government. In cognizance of this situation, the Bureau directed its legislative efforts this year toward modernization of the public land law. This goal involved recommendation to the Congress for repeal of obsolete laws, for consolidation and simplification of all legislation dealing with specific matters, and for greater generalization of laws now having limited applicability.

Progress is being made along these lines. The first session of the 84th Congress accomplished the outright repeal of the Timber and Stone Act of 1878, and of outdated laws requiring shore-space reservations along bodies of waters in Alaska by enactment of Public Laws 206 and 213. Both of the repealed measures in recent years proved of extremely limited usefulness, required considerable administrative expense with few positive results, and were largely inconsistent with conservation legislation and policy.

Congress also provided a means to permit a firm accounting of the total land claims against the Government in the form of scrip, lieu selection, and similar laws by passing Public Law 247 requiring the recordation of holdings and claims with the Secretary of the Interior. Recordation will permit an evaluation of the Government's liability to holders of land claims and development of administrative and legislative proposals for the satisfaction of the "debt." Previously, the 83d Congress passed Public Law 582 partially repealing the Carey Act which granted land to States for reclamation through irrigation. Public Law 582 provides means for settlement of the Carey Act grants to States. The State of Wyoming was the first to take advantage of the new law.

Several new bills to consolidate numerous laws are now in draft stage. Principal examples are proposals to consolidate, simplify, and modernize a whole series of laws relating to creation and disposal of

townsites on the public lands, and to rights-of-way for various purposes. Existing townsite laws include some which contemplate free settlement on the public domain, a situation which has not existed in the States since passage of the Taylor Grazing Act in 1934. Both proposals would repeal all existing laws on these matters and would substitute for them two single but comprehensive acts.

The 83d Congress made two significant amendments to generalize existing laws. Public Law 387 transformed the Recreation Act of 1926 from a limited recreation act to an act providing for disposals of lands for all public purposes, as well as recreation. Public Law 390 amended the Small Tract Act to make it more comprehensive both in terms of applicability and eligibility of applicants. Under consideration now is a proposal to amend the general public sale law to make it more comprehensive and workable.

Less comprehensive but useful measures passed by the 84th Congress were Public Law 76 which repealed the 160-acre limitation governing desert-land entries on lands valuable for nonleasable minerals, Public Law 77 which authorized the transfer of certain lands in Wyoming to that State for National Guard purposes, Public Law 191 to give Miles City, Mont., an additional 5 years to purchase certain lands, Public Law 215 which permits management and disposition of the so-called Choctaw-Chickasaw lands in eastern Oklahoma, Public Law 226 which permitted existing desert-land entrymen utilizing percolating waters in Arizona to perfect their entries, Public Law 258 which authorized issuance of patents to riparian owners along the Indian River, Fla., and Public Law 263 which permits the State of Utah to select mineral lands in exchange for certain State lands within the Uintah and Ouray Indian Reservation. The Congress also passed several private laws.

This is only a small part of all the bills the first session considered, indicating that the Congress despite the vast scope of existing law, must continue to delve into many new matters concerning disposal of public lands. Some of this is inevitable because changing times and special situations often require remedial legislation. Also equity and justice sometimes require deviation from the general rules in certain cases, and Congress reserves the right to consider those proposals which do not fit into the established complex of the public land laws. The Bureau, however, does follow a policy in the consideration of individual proposals to recommend either invoking of existing law or amendment of general law to make it more comprehensive and reduce to a minimum the need for the Congress to concern itself with individual transactions. Modernization of the public land laws will be a continuing goal of the Bureau's legislative program in the future.

Regulations and Procedures

The problems resulting from the existence of a vast body of public land laws are multiplied by the changing patterns of land-use and conflicting demands. Administration of the public land laws requires well-conceived guide materials for assistance to field officials in solving day to day operating problems. These are essential both to the public administrator who must make the decisions and also to applicants who should be fully apprised of their opportunities, rights, and privileges. Consequently, the Director's staff during the year placed high priority on the issuance of policy statements, manual procedures, and regulations.

A source of major difficulty last year and previously was the conflict between State selections and other applications. Since State selections in some of the States are often made on behalf of private individuals, there frequently arises a conflict between an applicant under State law and an applicant under Federal law. An overriding consideration to the solution of the problem is the obligation of the United States to satisfy the grants made by the Congress to the States. The various equities were carefully weighed and a policy statement was issued outlining fair and equitable rules for the disposition of such conflicts.

Another area of considerable difficulty was the application of the Desert Land Act of 1887 to present conditions in the West. Here again the problem is multilateral. Control of water is under State law which must be observed and respected. Stability of communities often rests on stability of water use. Proposals for water development may threaten the continued use of the land by existing users. To guide the Bureau in this situation and to inform the interested public of governing rules, the Bureau issued a policy statement covering operations under the Desert Land Act.

Other important policy statements issued during the year related to homesteading, small tracts, and disposals under the amended Recreation Act.

Work on the issuance of procedural guides through the Bureau Manual proceeded at an accelerated pace. Whereas the Lands volume was nonexistent in the spring of 1954, it now contains 54 releases, with several more in process. These up-to-date directives, which incorporate basic policy, have provided field personnel with a principal reference source, have streamlined operations and resulted in greater work output per man. The regulatory and procedural improvements applied to several fields of operation, including small tracts, disposals for public purposes, and withdrawals and revocations.

MINERALS

A major accomplishment during the past fiscal year was the complete decentralization of mining and mineral leasing cases to the various field offices principally in the Western United States. This was accomplished in line with the reorganization plan recommended by the survey team appointed by the Secretary, whose recommendations were adopted, approved, and ordered to be put in effect by the Secretary.

New legislation was introduced and enacted which will have the effect of encouraging new expansion of mineral activities and providing for the multiple use of the same tracts of Government lands for diverse mineral purposes.

In the administration of these various laws, BLM performs a basic, necessary function which contributes greatly to the proper conservation and development of the Nation's mineral resources so that they will serve not only the needs of the present generation but of generations to come.

Two of the most important new measures enacted are Public Law 555 and Public Law 561, both of which amended the 1920 Mineral Leasing Act.

The most important changes to the 1920 act brought about by these modifications are the increase in the acreage limitations on oil and gas leases and options, and the provision for terminating automatically for nonpayment of rent all noncompetitive leases on which there is no well capable of producing oil or gas in paying quantities on the anniversary date of such lease.

Enactment of Public Law 585 on August 13, 1954, was a major contribution to more efficient administration of mineral resources. It establishes a system of multiple mineral development by permitting mining and mineral leasing on the same tracts of public domain lands, and on patented lands in which the United States reserves title to the minerals.

Prior to the enactment of Public Law 585 the United States mining laws and the mineral leasing laws were mutually exclusive. A mining claim could not be filed on lands embraced in an oil and gas lease, nor could an oil and gas lease be issued by the Government for lands contained within a valid mining claim. This is now permitted under the provisions of Public Law 585.

The Bureau is responsible for implementing such new legislation by the preparation of regulations. The mineral leasing regulations were completely revised and new forms prepared, as well as new procedures for the guidance of the field personnel engaged in the adjudi-

cation of matters under the United States mining laws and mineral leasing laws.

The Bureau of Land Management engaged in numerous conferences with representatives of other governmental agencies which are vested with surface jurisdiction over certain lands, the minerals of which are subject to disposition by this Department and Bureau pursuant to various mineral leasing laws. These conferences resulted in a better understanding between the various Government agencies and this Bureau, and in the preparation of streamlined procedures for rendering more efficient service to the public.

Under the amended Atomic Energy Act of 1955, the Atomic Energy Commission is vested with authority to issue uranium leases covering public lands. The Commission has evinced a desire to transfer its leasing functions to BLM because of the Bureau's experience in mineral resource administration. It is expected that during the 1956 fiscal year these negotiations will result in a delegation of authority to the Bureau from the Atomic Energy Commission to handle such matters on a reimbursable basis.

Adjudication of Mineral Cases

The mineral activities of the Bureau increased substantially during fiscal 1955. On June 30, 1955, there were outstanding approximately 95,900 oil and gas leases on the public domain covering 71,700,000 acres. There were also outstanding 3,176 oil and gas leases on acquired lands of the United States covering 3,007,824 acres. A total of 1,218 permits, leases, and licenses for other minerals embracing 1,332,655 acres were issued on public domain and acquired lands.

During fiscal year 1955, new and reactivated noncompetitive oil and gas lease offers and applications for lease totaled 37,861 cases, and 38,676 were closed during that period. Approximately 18,505 oil and gas lease assignments were closed during the period.

As the result of the continued and greatly expanded search for uranium and other critical materials on the public domain, activities under the United States mining laws were greatly increased at a time when the various land offices were shouldering the additional burden of processing all applications under the mining laws. During fiscal 1955, 334 mining patent applications were received, as against 243 in fiscal year 1954 and 156 mineral entries were approved and patented as against 106 during fiscal year 1954.

Table No. 1 summarizes the number of mineral cases adjudicated in the continental United States and in Alaska during fiscal year 1955.

Revenues

Mineral leasing is the chief source of revenue derived by the United States from the use and disposal of the resources on the public lands. The revenues realized in fiscal year 1955 from royalties, rentals, and filing fees under the mineral leasing acts totaled \$59,861,932.39, compared with \$55,861,932 in fiscal year 1954. Another major source of receipts was bonus bidding for the right to lease lands in known oil and gas areas. A summary of the bonuses received from mineral leasing by States on lands within known geologic structures, as well as on the Outer Continental Shelf is contained in table No. 2.

Outer Continental Shelf

Interest in the leasing of submerged lands in the Outer Continental Shelf was the highlight of fiscal year 1955. As of June 30, 1955, 492 leases were outstanding covering 1,583,000 acres of OCS lands.

Important developments were establishment of an Outer Continental Shelf office of the Bureau at New Orleans, La., and the delegation of authority to the manager of that office to take action on mineral leases under the Outer Continental Shelf Act of August 7, 1953.

The first two sales of mineral leases in the Gulf of Mexico off Louisiana and Texas were held on October 13 and November 9, respectively, in Washington, D. C., resulting in the issuance of 114 leases covering 461,869.86 acres of oil and gas lands and 25,000 acres of sulfur lands. Total bonuses and rentals of \$142,404,630.48 were covered into the Treasury. Of the 404 applications filed to conform State issued mineral leases under section 6 of the act, less than 50 remained to be processed; most of these were Texas State leases awaiting official determination of the outer boundaries of that State.

A number of bills and resolutions introduced in the 84th Congress, proposing various amendments to the OCS Act, were received for analysis and recommendation. New regulations for rights-of-way for pipe lines on the OSC were proposed and published in the Federal Register.

During the year, the sum of \$22,041,994.66, which represented the amount owing to the State of California under the Submerged Lands Act from operations on the submerged lands along the coast of California, was duly paid by the Federal Government from funds in escrow.

A vast increase in mineral activities during the 1956 fiscal year is anticipated.

TABLE 1.—*Mineral adjudication operations in continental United States and Alaska, fiscal year 1955*

Type of case	Unclosed cases July 1, 1954	New and reactivated cases, fiscal year 1955	Cases closed during fiscal year 1955	Unclosed cases June 30, 1955
Public domain lands:				
Oil and gas leases (noncompetitive)-----	11, 113	35, 538	36, 692	9, 959
Oil and gas leases (competitive)-----	1	479	408	72
Mineral leases-----	112	485	392	205
Mineral permits-----	1, 757	1, 446	1, 394	1, 809
Acquired lands:				
Oil and gas leases (noncompetitive)-----	3, 797	2, 323	1, 984	4, 136
Oil and gas leases (competitive)-----		121	13	108
Mineral leases-----	7	5, 809	173	5, 643
Mineral permits-----		890	17	873
Mineral locations (patent applications)-----	641	360	295	706
Mineral locations (miscellaneous)-----	14	229	215	28
Oil and gas assignments (record title)-----	1, 536	23, 552	18, 505	6, 583
Resource sales-----	34	71	58	47
Outer Continental Shelf leases (sec. 6)-----		230	185	45
Outer Continental Shelf leases (sec. 8)-----		109	109	
Total-----	19, 012	71, 642	60, 440	30, 214

TABLE 2.—*Competitive leases, fiscal year 1955*

Mineral and State	Total ¹		Acquired lands		Public domain	
	Acres	Bonus	Acres	Bonus	Acres	Bonus
Oil and gas:						
Colorado-----	801.36	\$58, 527.89			801.36	\$58, 527.89
Louisiana-----	360.06	5, 629.41			360.06	5, 629.41
Outer Continental Shelf-----	1, 381, 767.23	116,378,476.00				
Michigan-----	40.00	3, 044.40			40.00	3, 044.40
New Mexico-----	5, 113.90	180, 261.69			5, 113.90	180, 261.69
North Dakota-----	6, 908.17	76, 482.07			6, 908.17	76, 482.07
Texas: Outer Continental Shelf-----	202, 508.70	23, 357, 929.48				
Wyoming-----	2, 921.69	509, 359.86			2, 921.69	509, 359.86
Total, oil and gas-----	1, 600, 421.11	140,569,710.80			16, 145.18	833, 305.32
Other minerals:						
Coal: Kentucky-----	458.00	503.80	458.00	\$503.80		
Manganese: Virginia-----	2, 291.00	1, 500.00	2, 291.00	1, 500.00		
Phosphate: Montana-----	560.00	2, 800.00			560.00	2, 800.00
Sodium: California-----	10.00	410, 000.00			10.00	410, 000.00
Sulfur: Louisiana, Outer Continental Shelf-----	25, 000.00	1, 233, 500.00				
Total, other minerals-----	28, 319.00	1, 648, 303.80	2, 749.00	2, 003.80	570.00	412, 800.00
Grand total-----	1, 628, 740.11	142,218,014.60	2, 749.00	2, 003.80	16, 715.18	1, 246, 105.32

¹ The total column includes Outer Continental Shelf data not shown elsewhere.

RANGE MANAGEMENT

Fiscal year 1955 was marked by generally unfavorable climatic conditions for livestock operations throughout the public land range area, with the exception of parts of Montana. Severe drought continued to plague the Great Plains, Intermountain, and Southwest ranges. Scattered storms brought temporary local relief but failed to overcome

the effects of a cumulative deficit in moisture. The drought in some areas, notably Wyoming and parts of the Southwest, was the worst in history.

Aggravating the drought was a long, hard winter in the Northern States, with short feed supplies causing a sharp decline in the condition of livestock. Many operators were forced to dispose of part or all of their breeding herds. The Bureau remitted grazing fees to numerous operators whose ranges failed to produce sufficient forage to sustain their herds. A new regulation was placed in effect to enable the remission of rentals on section 15 grazing leases, a provision heretofore unnecessary.

The severe winter was followed by a long-delayed spring and tardy development of range forage. Turnout dates for livestock were the latest in history in some areas. Indications of a break in the drought occurred when late spring rains improved forage and stock water supplies in many range areas. There were still localities where the drought continued unabated and livestock operations were in a critical state, however.

Progress in Range Administration

The highlight of grazing administration in the past year was the adoption of a new formula for determining grazing fees. Instead of basing fees on administrative costs, the new formula provides for charging grazing fees equal to the average price per pound of cattle and sheep at Western markets. The new formula will become effective on January 1, 1957. For the calendar years 1955 and 1956 an arbitrary increase in fees of 25 percent was agreed upon. Beginning with 1955, the range improvement fund will be derived from 25 percent of the grazing fee per animal unit month, rounded to the nearest whole cent.

Revision of the Federal Range Code for Grazing Districts was another major accomplishment of the past year. This undertaking has been in progress for several years in order to improve the enforcement of the Taylor Grazing Act and to bring the language of the regulation into line with existing practices. The National Advisory Board Council and the grazing district advisory boards cooperated in developing and drafting the revision.

The adjustment of grazing obligations on the Federal range to the grazing capacity continued to receive primary attention. Encouraging progress was made in the reappraisal of grazing privilege adjudications with the support of new range inventory and dependent property survey data. There has been a general tightening of dependent property survey standards and more exactness in assembling the information. The result has been a steady decline in unqualified demand and improper grazing practices on the Federal range.

A noteworthy increase in cooperation and team work between Bureau employees and stockmen users of the Federal range has facilitated stocking adjustments, dependent property surveys, trespass control, and other range activities. This development is doubtless due to an increasing conservation-mindedness among stockmen generally, possibly attributable in part to the prolonged drought.

With an accelerated adjudication program, many adverse decisions have been rendered, and while the backlog of pending grazing appeals has grown, the increase is not proportional to the number of users affected. Satisfactory agreements were often reached when range managers and permittees worked together on the ground to make necessary adjustments in use.

Wildlife Management and Recreation

The management of wildlife is strictly on a basis of cooperation between the BLM as the administrator of vast public land acreages, supporting large wildlife populations, and the respective States recognized as the owners of the wildlife.

Cooperation starts with joint consideration of all aspects of management by the State game departments and the Bureau and other land-managing agencies or individuals. This work goes on constantly and usually culminates in a series of annual meetings held in the respective States where full and frank discussion of all points of controversy are compromised or settled. Bureau representatives attend local and national meetings to present our story of management of the public range lands. Wildlife problems of mutual interest to other agencies such as the Forest Service and Fish and Wildlife Service receive constant attention. Joint investigation and study of problem areas is made as, for example, on the Fort Peck Game Range in Montana. Here a four-way agreement among the Corps of Engineers, Fish and Wildlife Service, State of Montana, and the BLM is necessary to provide coordinated management of the area.

The general public must also be kept informed as to the status of wildlife. Cooperation with the public is provided for by the system of local State and national advisory boards serving the Bureau, each of which now has wildlife representatives. The Bureau broadened the scope of this representation during the past year by having for the first time three wildlife representatives on the National Advisory Board Council which acts in an advisory capacity to the Director's office in Washington.

In the field of recreation the Bureau's activity is chiefly confined to Alaska, although extensive cooperation is given other Federal,

State, and local groups in the States. In Alaska the Bureau cooperated with the Territorial Department of Fisheries and the Fish and Wildlife Service in the selection of lands for reservation as public recreation and service sites along the Alaska Highway.

Range Studies

Enlightened management of the rangeland calls for basic knowledge of the land and the vegetation which it is supporting. Studies to determine existing conditions are usually referred to as range inventories. The Bureau is making every effort to step up this program and range forage inventories are now being made in most range districts which have not completed this work.

Following inventory must come studies to determine why the range and soil is in the condition it is in; what is the overall trend of condition, up or down; and what method of treatment or type of use must be made to improve it.

The Bureau is rapidly expanding the scope of such work. Range studies have been spotlighted as a necessary program for every field office. They are being made on a varying scale—intensive, in critical or key areas, and extensive elsewhere, in order to provide as much coverage of range as possible. A Bureau employee has devised a new approach to extensive study of the range which will make it possible to ascertain conditions on a much greater acreage than has hitherto been possible. This year marked the first attempt by the Bureau to assemble a report of range condition and trend of all Bureau lands, exclusive of Alaska. This report will be submitted each year and steady improvement is expected as to reliability of information and scope of country studied.

Range studies of this nature are often made jointly with private individuals or groups, States, or other Federal agencies. Cooperative vegetal studies of our ranges have been set up in many areas. An example is the Little Hills Experiment Station in Colorado, where a series of deer and livestock enclosures are undergoing careful study and recordation of use to determine the degree of livestock-big game competition for forage and other management factors. Cooperative study of game ranges by the use of intensive line transect stations has been set up on BLM-national forest-private ranges in eastern California and western Nevada under the leadership of the California State Game Department.

In Alaska the Bureau is cooperating on a research project with the Alaska Agricultural Experiment Station and other Federal agencies to reevaluate the physical and economic bases for range land use and development on Kodiak and adjacent islands.

Soil and Moisture Conservation

Conversion of S. and M. C. activity to watershed protection planning was virtually completed at the end of the fiscal year. This conversion places the Bureau's soil conservation program in readiness for the first year of the Department's 20-year program of conservation treatment for all Interior lands in continental United States. The Bureau now has reasonably reliable estimates of the total conservation requirements for all public lands in the major western river basins. These estimates will enable the establishment of watershed priorities and the orderly scheduling of operations.

The conversion to watershed planning is also timely in that the Bureau's program is immediately susceptible of close coordination with the Department of Agriculture's watershed protection program authorized by Public Law 566, 83d Congress. This law directs Interior to cooperate with Agriculture in providing for public lands in watersheds eligible to receive assistance under the act. During the past year this program was just getting under way with one or two watersheds containing public lands approved for planning in each of the Western States. As the program develops it is anticipated that it will become an important supplement to the Bureau's soil conservation activity.

The preparation of community watershed plans, the next step in converting the Bureau's program to a watershed basis, has proceeded according to schedule. Most of the grazing districts are working on at least one plan and several have been completed and submitted for approval. These plans are usually cooperative endeavors with our Federal, State, and local agencies with an interest in the watershed participating in planning phases.

Range reseeding occupied a prominent place in the 1955 fiscal year conservation operations as a result of congressional action. The Dworshak bill, Public Law 524, transferred 252,000 pounds of surplus forage seeds from the Commodity Stabilization Service to the Bureau for seeding public lands. Also, a House recommendation earmarked funds for aerial seeding either with or without pelletized seed. The two actions were combined to the extent of using some of the surplus seed for aerial seeding. A total of 37,500 acres of depleted range located in eight Western States was covered in the aerial seeding program. Of this total, 2,000 acres at two locations in Idaho were seeded with pelletized seed as a large scale trial of this method. Preliminary results based on careful check plots, installed and recorded by the Agricultural Research Service show no advantage in using pelletized seed.

Range users have customarily cooperated with the Bureau in placing conservation works on the public lands by contributing labor, mate-

rials, and funds. During the past year interest in range conservation work has increased markedly and users have been more cooperative. This fact was noted above under progress in grazing administration and is equally true of other range management programs. The greater interest in conservation practices can be attributed in part to the success of past Bureau efforts to restore and improve the public land ranges. Also important, is the educational influence of pilot soil conservation districts, some of which have been operating for four years and are receiving favorable local publicity. The Bureau has consistently supported the pilot district movement and is abreast of scheduled conservation work on public lands included in such districts.

Range Improvement

A revised policy governing the distribution of range improvement funds shifted the emphasis in 1955 from new construction to the maintenance of existing improvements. A substantial part of the maintenance load, however, is borne by range users under cooperative agreement permitting new construction to proceed at near normal level. The accomplishments in this program during the past year in a measure reflect the accelerated effort on range adjudication since fencing generally received the major emphasis. With range lines and allotment boundaries permanently established, there is an understandable desire on the part of the users to fence the range. The usual practice followed by the Bureau is to furnish the wire, with the users furnishing other materials and labor to construct the fence.

Private construction of range improvements on the public lands authorized by section 4 and section 15 permits increased in volume over previous years. Here again the Bureau's stepped-up adjudication program is reflected in the amount of fencing completed and the installation of stockwater facilities and other improvements.

Halogeton Control

Encouraging results have been obtained in the Bureau's halogeton control program. While this poisonous plant is still a serious threat, definite progress has been made in slowing down its rate of spread to new lands and in some areas the plant is being successfully controlled.

Between 1952 and 1954 the acreage of Bureau land infested jumped from a little over 1 million acres to more than 4 million acres. Recent surveys disclose that the exterior boundaries of the gross area of infestation have not been materially extended since 1954, except in areas where control measures could not be carried out. There have been sharp increases in untreated areas, areas within or near major infestations, and new spot infestations, widely scattered, are occurring.

Major emphasis has been placed on the seeding of infested and threatened ranges to hardy perennial grass as the most practical way to control halogeton. The hardy grass crowds out or prevents the spread of halogeton and produces forage for livestock removed from areas of infestation that are unsuitable for reseeding.

Approximately 81,000 acres of rangeland were seeded in fiscal year 1955, bringing the total acreage seeded since inception of the program in 1952 to about 403,000 acres. In all reseedings the Bureau has been successful in obtaining the full cooperation of the range users in project development and subsequent management and use. Range users have contributed seed, fencing, labor, and funds to help in financing the project. Contributions have been averaging about 24 percent of the total cost of the project.

An unusually high degree of success has been obtained in the reseeding program thus far, and the successful seedings in all cases are eliminating halogeton or reducing the volume present below critical quantities. As the grass becomes more firmly established with maturity it is anticipated that halogeton will be completely eliminated, except in small areas of poor soils where it is not possible to obtain a dense vigorous stand of grass. Several of the reseedings were grazed by livestock for the first time in the fall of 1954 and the spring of 1955. This made it possible to reduce the grazing use in the surrounding range and allow for its gradual improvement. In areas where reseedings have been able to absorb a relatively high percentage of grazing capacity of an area, significant improvement can be seen in the native range as a result of the reduced use.

Chemical Control of Halogeton

In the Bureau's chemical program, the objective is to eradicate small isolated spot infestations, prevent seed production and reduce the rate of spread in perimeter areas and along avenues of spread. About 83,500 acres have been treated since 1952 and about 15,000 acres are sprayed on an annual basis. Several small spots have been eradicated and infestations along avenues of spread and in perimeter areas have been materially reduced.

In 1954 and 1955 research agencies developed important basic information on the life history of the plant and on the proper application of chemicals to the weed which will enable the Bureau to carry out a more effective control program in 1956 and in future years. The Bureau's chemical control program is largely carried out as a coordinated cooperative program with local and State weed and plant pest control groups, State highway departments, railroads, private landowners, and others.

Other Halogeton Control Methods

In the drier, poor soil areas of the Federal range where reseeding cannot be successfully established, the Bureau is attempting to control halogeton by better range management. The objective is to improve the hardy native range plants in vigor and density to such a degree that halogeton will be crowded out. Management fences to control grazing, water spreading, and contour furrowing projects to catch and utilize additional moisture and reduction in grazing use are practices used in this program. While this is a long-range means of control it will be more permanent when once accomplished. Since inception of the program more than 1,000 miles of protection and management fences have been built and more than 87,000 acres have been included in forage development projects. In several of these areas it appears that the native vegetation is gradually crowding out halogeton.

In addition to the Bureau's control program, surveys are carried out annually to determine areas of infestation, avenues of spread, and appropriate control measures. Good cooperation has been obtained from State and local people and agency representatives in reporting new infestations.

The Bureau also cooperates with the State land-grant colleges and research agencies of the Department of Agriculture on an annual basis in research programs designed to find better methods of control. Considerable information has been developed that has greatly benefited the Bureau's control program. This important phase of the program will be continued in the future.

During the fall of 1954 and winter of 1955 the Bureau made an appraisal of its halogeton control program to determine its good and bad features and to obtain suggestions from others that would aid in improving future work. State and local committees composed of personnel from the State colleges, extension services, the Department of Agriculture, State fish and game commissions, key ranchers, and other local and State people assisted in making the appraisal. They commended the Bureau on its overall approach to the halogeton problem and urged that an aggressive program be continued until halogeton is controlled.

FORESTRY

The Bureau manages approximately 161,500,000 acres of forest and woodland in the United States and Alaska. Of this, approximately 36,496,000 acres are in the continental United States, 6,376,000 acres being commercial forest land and 30,120,000 acres, noncommercial or forest woodland. The 125,000,000 acres in Alaska contain

40,000,000 acres of commercial forest land and 85,000,000 acres of woodland.

This tremendous acreage is estimated to embrace almost 260 billion board-feet of timber on the commercial forest lands alone with another 212.5 billion board-feet standing on the less productive woodlands. Although no accurate inventory has been made of a large portion of this area, Bureau foresters estimate that the productive capacity of these forest and woodlands approximates 3.5 billion board-feet per year, or enough lumber and equivalent wood products to construct 350,000 five-room homes each year in perpetuity. The drain of forest products from this great reservoir was 763 million board-feet in fiscal year 1955.

Bureau Timber Sale Business

The value of timber sold from Bureau forest lands in fiscal year 1955 was the greatest in the history of the Bureau. The volume disposed of in fiscal year 1955 and the sale value were 763,243,000 board-feet of timber and \$19,903,301.45, respectively, compared to 696,115,000 board-feet of timber valued at \$12,627,521 sold in fiscal year 1954. These figures include timber involved in trespass settlements.

Timber from the Oregon and California Railroad and Coos Bay Wagon Road grant lands accounted for 644,608,000 board-feet of the total sold and \$18,337,387.55 of the total value. Public domain timber sales and other types of disposal accounted for the remainder, 118,635,000 board-feet of timber valued at \$1,565,913.90.

During this period, the Bureau expended \$2,644,840 for the management and protection of these lands. This represents a ratio of expenditures to income of 1 to 7.5 or \$7.50 earned for every dollar spent on management and protection. Even after distributing substantial shares to the various public land States and counties, the Federal Treasury realized a net \$3,347,000 income for fiscal year 1955.

In addition the Bureau expended \$2,500,000 on the construction of timber access roads on O. and C. lands in western Oregon. These roads are designed to tap a tremendous volume of salvage timber in inaccessible areas which would be lost entirely if not salvaged soon. This expenditure is in the nature of a capital investment, using funds which normally would have been distributed to the O. and C. counties in Oregon. This investment will be repaid in full with net gains both to the counties and the Federal Treasury through higher sales revenue resulting from wider, more efficient harvesting. From its inception in fiscal year 1951 approximately \$8,550,000 has been spent on this program as of June 30, 1955. As a result approximately 113 miles of heavy-duty logging roads have been built or are under construction.

Public Domain Forests

The Bureau is faced with several distinct and separate problems in its efforts to conduct a financially sound and conservationwise forest management program. These may be simply described as problems of land ownership and economic development.

In most of the public land States, the forest land administered by the Bureau is admittedly the poorer forest land, remnants of the once all-inclusive public domain from which were carved the national forests and extensive private holdings. These scattered stands have many important values only one of which is the actual yield of forest products. The value of forested land for watershed protection, scenic or recreational use, wildlife and grazing, can be destroyed or at least seriously impaired by timber cutting which has not been planned with consideration of these factors. The forest and woodlands of the public domain within the United States, not counting the O. and C. lands, constitute approximately 4½ million acres covered with saw timber stands and 30 million acres covered with woodland types. Development of a high-level sustained-yield rate of cutting has not been achieved as yet. Increasing demand for the products grown on these lands assures a ready market. Continued and increasing effort by the Bureau is called for to realize the full productivity of these lands. At the present time, timber operations are at about 20 percent of what could be considered an adequate management level on these public domain lands.

Establishment of a district forestry office at Coeur d'Alene, Idaho, to facilitate all management activities over more than 200,000 acres in northern Idaho was a major step forward in an expanding forest management program.

Lack of adequate inventories still hampers attainment of a well planned management program. During the past year some small gains were scored in this activity but they were far from adequate in view of the tremendous need and the total job ahead.

In general, the limiting factors in the administration of a management program for these lands during fiscal year 1955 were the capacity of available manpower to provide even minimum conservation measures essential for proper utilization of existing timber as well as future growth, and the inadequate knowledge of the extent of the resource.

In spite of these handicaps, values realized from these lands continued to rise during the past year. Income exceeded expenditures by over 2 to 1, thus emphasizing future possibilities.

The last major reservoir of untouched timber under the American flag is located in Alaska. The more than 125 million acres of forest

and woodland under the jurisdiction of the Bureau in Alasaka hold promise of a great contribution to the economic welfare of the nation. At the present time one of the major concerns of the Bureau in its management of these lands is their protection from fire. On a much smaller scale the Bureau conducts a timber sale program fulfilling the requirements of local sawmills and settlers. During the past year, the timber sale business in Alaska realized an income of \$19,130.

During the past year the Bureau has developed a specific forestry program for Alaska which outlines in detail the needs of the territory in research, forest inventory and resource development. The plan calls for doubling of the forest management and fire protection activities of the Bureau in Alaska. Efforts will be made to place this new program into effect during the next few years.

O. and C. and CBWR Land

The O. and C. Act of August 28, 1937 required that the forests on the O. and C. lands in western Oregon be managed in accordance with the principles of sustained-yield management. This was the first instance of Federal lands being specifically earmarked by Congressional action for application of sustained-yield forestry. Every year since then the volume of timber sold and the value of that timber have increased.

As a comparison, the Bureau in fiscal year 1947, 9 years ago, sold 448,722,000 board-feet of timber valued at \$3,085,425. This was 84 percent of the presently established sustained-yield allowable cut of 534,451,000 board feet per year. During fiscal year 1955, the Bureau sold 644,608,000 board-feet valued at \$18,337,387. This was close to the presently established allowable cut. A large volume of this timber was salvage material. Sustained-yield forestry proved to be a lucrative business on the O. and C. lands during fiscal year 1955.

In addition many other management activities were carried out during the past year. Several thousand acres of forest land were planted with Douglas-fir seedlings to assure a continuing high level of productivity 100 years from now. Also, additional thousands of acres of cut-over forest land were seeded to Douglas-fir and other species. Closing the gap between cutting time and the reestablishment of a new stand permits higher annual cutting ratio in the presently mature timber in addition to more efficient management in the future.

In the closing days of fiscal year 1954, Congress directed the Bureau and the Forest Service to effect an exchange, based on equal value, of the lands administered by the two agencies where such lands were intermingled. This exchange involves almost 1 million acres of forest land, half being national forest and half O. and C. land. When com-

pleted, this exchange will remedy the overlap of jurisdiction of the two agencies in western Oregon by blocking up the lands affected. It will also improve the administration of these lands by more efficient groupings of land and by reduction in the public confusion over management rules and practices of the two agencies operating in the same area. Congress imposed a 2-year time limit for the completion of the exchange. During the past year almost all the field work has been completed and it is expected that the exchange will be consummated well within the period set by Congress.

Trespass

The scattered nature of many Bureau of Land Management lands emphasizes the difficulties experienced in the development of an adequate trespass control program. Recent Bureau decentralization has contributed greatly to progress in this activity but increasing use of the public lands also increases the possibilities of overt or inadvertent trespass. This was true during the past year and will continue to be true as long as the use and the value of the public land resources continue to rise. More adequate supervision of land-use would do much in alleviating this problem.

Access Roads

The Federal access road program initiated on the O. and C. lands during fiscal year 1951 continued at an accelerated pace during the year. The Bureau is attempting to carry out this program with the full cooperation of the local landowners. During the past year several long-term agreements were negotiated which assured the early completion of road construction into heavily damaged stands of mature Douglas-fir.

Forest and Forage Protection

Adequate protection from fire, insects, and disease is essential to successful management of the Bureau's extensive timber and forage resources.

The emphasis placed on fire protection during the past several years by the Bureau of Land Management is showing results in both the United States and Alaska. In spite of the limited funds appropriated for protection, much has been accomplished to improve fire control for the forest lands under BLM jurisdiction—some 225 million acres in Alaska and 180 million acres in the United States.

Since formal protection was extended to Bureau lands, cooperation with other agencies, Federal, State, county, and private has been considered essential. In the United States the great extent of BLM

lands intermingled with other ownerships has made cooperation in fire control imperative.

Development of better fire plans has made possible efficient operation on most fires while keeping the manpower requirements at a minimum. Use of mechanized fire equipment which minimizes manpower requirements on most fires has made possible a marked reduction of fire severity, i. e. acreage burned per fire.

Very high frequency (VHF) radio has been used successfully to furnish dependable communications in the severe fire danger districts of Idaho and eastern Oregon. VHF radio has also been installed on one district each in Montana and Arizona and on two districts in Nevada. Radio telephone is used successfully in one district each in Nevada and Utah. Both VHF radio and radio telephone permit noise-free reception during periods of high electrical activity common during electrical storms and other periods of high fire danger. At present long-haul transmission makes medium frequency radio more adaptable for use in Alaska. All radio equipment except that in the aircraft has been rebuilt from radios obtained from military surplus.

High-pressure pumpers mounted on multiple drive trucks have proved so satisfactory in suppressing grass and brush fires that they have been adopted by the Bureau as standard fire-fighting equipment. As funds become available, all districts will be equipped with these pumpers. The Pacific Marine type pumpers are better suited for use in the forests of Alaska, although in some places the high pressure pumper has also proved to be equally effective in Alaska.

Three Grumman amphibian aircraft were acquired in 1953 through transfer from the Navy for use in Alaska fire control. These aircraft have been used very effectively to transport fire fighters and equipment to lakes and airstrips near fires, thus reducing the elapsed time for discovery to initial attack. With three 4-place, wheel-type planes for patrol, scouting of fires, and for air-to-ground radio contact with fire fighters on the fireline, the efficiency of the fire organization has been greatly increased. Further progress has been made in aerial cargo dropping. Tools, equipment, and food have been supplied in this way to men on the fireline.

Contract protection of nearly 4 million acres of public domain, forest and woodlands in the States of California, Idaho, Oregon, Montana, Washington, Arkansas, and Minnesota was continued. These lands are scattered and intermingled with ownerships of other agencies having protection organizations. For the Bureau to protect these lands under force account would be a duplication of effort. An additional 2,142,000 acres of BLM-administered O. and C. lands in western Oregon bearing high-value Douglas-fir saw timber are protected by contract with the State of Oregon and the Forest Service.

Greater emphasis has been placed on improvement of the fire training program by extending the training to per diem guards and by requiring a larger number of Bureau of Land Management employees to attend the training schools. Bureau of Land Management attendance at fire training schools in cooperation with other agencies has also been increased.

Insect control.—Insect infestations are difficult to detect and may be present for several years before damage is noticeable. They often reach epidemic proportion before adequate control measures can be effected. While far less spectacular than fire, annual damage by insects exceeds that of fire and the ravages are much more difficult to control. The infestation of Douglas-fir bark beetle in the Douglas-fir region of western Oregon, California, and Washington during the past 4 years reached its peak toward the close of 1954.

Favorable breeding conditions were created by numerous fires in western Oregon and the extensive blow-down by the heavy wind storms of 1951, 1952, and 1953. There were over 10 billion feet of blowdown timber distributed over an area of 13½ million acres with an estimated 3 billion feet on the 1.4 million acres which are under BLM jurisdiction. Because much of the blowdown is inaccessible and in small scattered pockets, it cannot be salvaged economically. This condition continues to create a breeding ground for the beetles. At present there is no effective means of control other than removal of the fire-killed and wind-thrown timber to minimize their spread. To make salvage operations possible, it was necessary to build access roads into the larger bodies of damaged timber.

Since 1952, approximately 1.3 billion feet of damaged timber have been salvaged from areas that could be reached from existing roads. By the fall of 1955, approximately 50 miles of access roads were ready for use, providing access to large bodies of previously inaccessible, beetle-damaged timber.

A beetle infestation in northern Idaho resulted in considerable damage to spruce timber on Bureau of Land Management lands. More than 20 million board-feet were salvaged during the past year.

The spruce budworm infestation in the Ochoco and Malheur National Forests and in the Powder River and Baker watersheds in eastern Oregon will receive treatment in fiscal year 1956. This will affect approximately 14,000 acres of BLM lands adjacent to or intermingled with the national forests and lands of other ownerships.

Disease control.—As high demands on timber continue, it becomes more important that prevention and control of disease in all kinds of timber should be given increased attention. The only known epidemic tree disease affecting Bureau-managed timber is white pine blister rust, a disease common to the 5-needle pines. A blister rust control

program was started in 1942 on 150,000 acres of commercial sugar pine near Medford, Ore. The present project area is 98,419 acres. During the last field season, 2,131 acres were treated with initial eradication and 10,788 acres with reeradication.

As a sanitation measure, timber sale contracts for BLM timber in New Mexico stipulate the removal of all mistletoe and conky trees along with other merchantable timber. Further damage to young timber is thereby reduced.

CADASTRAL SURVEYS

The Bureau of Land Management is the official agency for conducting the cadastral surveys of the public lands. These surveys determine the official marking of land boundaries and are therefore basic to the management of the lands and the development of resources throughout the Western States and Alaska. The intermingling of privately owned lands with the public lands has made this function one of outstanding importance as the boundaries of the public lands must be known and actually marked on the ground before the agency administering those lands can successfully carry on its operations.

Most of the public lands are situated in the 11 Western States. In those States there are more than 100 million acres of public land over which the cadastral survey "net" has never been extended. In addition, over 50 million acres of public land in the 11 Western States are in need of resurvey to rehabilitate and redefine the corners and lines marking the boundaries of the public lands. On the other hand, more than 1.3 billion acres comprise the total area which has been surveyed.

The cadastral survey program of the Bureau of Land Management for fiscal year 1955 was designed to aid in the development and conservation of the natural resources, to provide homesites for our increasing population, and to mark out on the ground the boundaries of lands which the States were granted for benefit of their schools. Consideration was given to making surveys and resurveys in those areas which would result in the production of revenue, as well as stimulus to private industry. In Oregon, for example, the timber sale program has been retarded because surveys are necessary to define the boundaries between private and Federal lands, for settlement of trespass, and for the determination of the boundaries of sales units.

A major item in the program included the survey of school sections. By provision of law, the States situated in the area of the public domain are entitled to certain specified sections in each township for school purposes. The sections must be surveyed before the States can secure title to them. The vast increase in the development of the re-

sources of the public lands has created an increasing demand for their survey since the removal of those resources depletes the value of the land and would tend to reduce the future returns to the States of revenue from their school lands.

The subdivision of areas into units of 5 acres or less to meet the demand for homesites and the resurvey of areas for oil and gas leasing and exploration, where the original survey monuments have been obliterated, constituted a material part of the program. In Alaska, surveys were made primarily for settlement purposes and to accommodate the expanding economy of that Territory.

Surveys in Continental United States

Cadastral survey projects completed during the past fiscal year consisted of the survey or resurvey of 1,241,734 acres of land. The surveys included such essential work as the identification of the sections granted to the States for their schools; the survey and resurvey of mineral lands as an aid in the development of those resources, principally oil and gas; the resurvey of forest areas to define the boundaries of timber management units and provide a basis for timber sales; the survey of grazing lands for range improvements; and the survey of small tracts to provide home and business sites to meet the demands for our increasing population. Additional projects were carried on by BLM to facilitate the land management activities of other Federal agencies such as extensive resurveys for the Bureau of Reclamation in the Missouri River Basin; the establishment of the boundaries of the Coronado National Memorial in Arizona, and the Everglades National Park, Fla., for the National Park Service; the subdivision of areas in Arizona to accommodate the transfer of lands by the Department of the Air Force; and resurveys for the National Forest Service in Colorado.

The program also included miscellaneous surveys and investigations including the survey of islands and omitted land areas. Numerous maps and diagrams were prepared for the Department of Justice in connection with pending litigation involving claims by the Indians.

The survey of school sections made almost a quarter of a million acres of new lands available to three western States. Although there are large areas of unsurveyed land remaining in all the western States, the need for completing the original surveys in order that the States may obtain title to the school lands exists primarily in Utah, Arizona, and California. In the other western States the unsurveyed areas are located principally in permanent reservations such as national forests, Indian reservations, national parks and monuments, etc., and title to the designated school sections would not pass to the

States even when surveyed. Furthermore, indemnity selections have been taken by the States for a large portion of the designated unsurveyed school sections in the reservations and the school land grant to those States, to a large extent, has been satisfied.

In order to make the maximum quantity of school lands available to the States, the Bureau adopted the plan of surveying and monumenting only township boundaries and only the boundaries of the school sections in each township, instead of making a complete subdivisional survey. Since there are 36 sections in each township, not more than 4 of which are designated school sections, this method made it possible to survey nearly three times more school sections than could have been surveyed if the townships were completely subdivided. In general, the program of work was based on the desires of the States to cover the areas of greatest value and interest. During the year, the school sections surveyed and marked on the ground totaled 137,840 acres in Utah, 60,160 acres in California, and 39,520 acres in Arizona—an aggregate of 237,520 acres.

Outer Continental Shelf

During the fiscal year, leasing maps were completed covering approximately 12 million acres of the Outer Continental Shelf offshore from Louisiana and 8 million acres lying in front of Texas. These maps in general cover the area extending seaward from the coastline to a depth of about 120 feet. They are basic for determining location on the ground and for providing descriptions and areas for the water-covered areas being leased for oil, gas, and sulfur as result of the passage of the Outer Continental Shelf Lands Act on August 7, 1953.

Alaskan Surveys

The basic requirement for land settlement in Alaska, as in any other public land area, is the establishment by cadastral survey of the boundaries of the tracts to be settled upon. The field program was designed to meet the needs of the increasing population in the Territory and to accommodate the expanding economy. Less than 1 percent of the vast area of Alaska has been surveyed and the need for accelerating the cadastral surveying programs is pressing. During fiscal year 1955 funds allocated to Alaska for cadastral survey were increased approximately 60 percent over the allocation in fiscal year 1954.

The program for the fiscal year included the survey or resurvey of approximately 75,000 acres of land under the rectangular system, compared to 22,000 acres in fiscal year 1954. In addition the pro-

gram included the survey of 297 small tracts, 32 miles of highway and railroad traverse, 38 homesteads, 33 homesites, 10 trade and manufacturing sites, 7 headquarters sites, 1 Alaska Public Sale Act, 1 Territorial airfield, 1 United States reserve, 4 recreation sites, 423 lots in 4 townsites, 2 Indian allotments, 2 miscellaneous surveys.

FISH AND WILDLIFE SERVICE

John L. Farley, *Director*



IN EXERCISING Federal responsibilities for the Nation's fish and wildlife resources, the Fish and Wildlife Service this year has strengthened its teamwork with State and Federal agencies, other organizations, and industry. Under the Saltonstall-Kennedy Act, promotional service and biological and technological research is benefiting the fishing industry. Wildlife and fish restoration under the Pittman-Robertson and Dingell-Johnson Acts continues to improve those resources. Closer relations with the States have been achieved in the administration of migratory bird laws.

UTILIZING THE COMMERCIAL FISHERY RESOURCES

The Service's commercial-fisheries activities in exploration, technology, market development and education, statistics, market news, and economics were expanded considerably during the year. Funds were made available by the Saltonstall-Kennedy Act to strengthen the American fishing industry, with emphasis on research and marketing.

Continuation of tuna explorations by the research vessel *Oregon* produced valuable information on the distribution and seasonal availability of various species of tuna in the Gulf of Mexico and adjacent waters of the Caribbean Sea. Technical assistance and advice were furnished to a number of commercial fishermen who converted their vessels to enter this new fishery, first discovered by the *Oregon* in 1954.

In Alaska, the exploratory vessel *John N. Cobb* completed a survey of potential summer fishing grounds in the Prince William Sound region. Commercially important discoveries were made of Pacific Ocean perch, sablefish, shrimp, and king crabs.

The trawler *Delaware* completed a number of exploratory cruises in deep waters of the Gulf of Maine. Good catches of large ocean perch and large lobsters were made, and a shrimp resource formerly fished

was relocated in more northern waters. Research on Maine herring was started, with transfer of the research vessel *T. N. Gill* to Boothbay Harbor, Maine. Bluefin-tuna exploration was continued, with several good catches despite two hurricanes that disrupted the project.

At the Coral Gables, Fla., gear-research station, midwater trawls and shrimp trawls were successfully studied in operation with underwater television equipment. Recordings of sounds produced by commercial varieties of shrimp were obtained for the first time.

The program for the development of voluntary Federal standards of grade and condition of fishery products, begun last year, has moved ahead with gathering momentum. The standard for Maine sardines was completed and is in use by the State and the Maine sardine industry. Standards are being developed for frozen cooked fish sticks; fish blocks, the raw material from which fish sticks are usually made; and breaded shrimp. Industry cooperation in the development of these standards has been marked.

Interest centers around research on new uses for fish oil and development of a quality index for fish meal. Twenty contractors are busy on segments of this research. In addition to the work at Service laboratories, a field study at a reduction plant is being conducted jointly with the industry. The effect of season, locality of capture, size of fish, processing variables, and storage conditions on the meal, oil, and condensed solubles will be determined.

Two special market-promotion campaigns were conducted to move the surplus stocks of small haddock fillets and canned tuna. Emphasis was given to increasing the use of these fishery products by institutions. A special citywide fish-promotion program was conducted in Columbus, Ohio. This was a joint trade association and Government-sponsored campaign to test the effectiveness of concentrated promotion.

Three educational motion pictures were undertaken during the year. Two of the pictures are being financed by private industry. One will show the use of outboard motors in the commercial fisheries while the other will show various methods of preparing shrimp for the table. A contract was awarded for the third film, Government-financed, which will be on the nutritional values of fishery products.

A special study on the marketing of fishery products of Florida is being conducted, under contract, by the University of Miami.

Home economists of the College Park and Seattle test kitchens presented 131 fish-cookery demonstrations to school lunchroom personnel in 17 States. Thirteen demonstrations were presented to nonschool groups.

General statistical surveys for 1953 were completed for all sections of the United States except the Mississippi River and its tributaries. Similar surveys for 1954 were started for all sections.

Issuance of monthly bulletins on landings of fishery products in Maine, Massachusetts, New Jersey, Florida, Alabama, Mississippi, and Texas was continued. Arrangements were completed for similar bulletins for North Carolina and California. Monthly bulletins were published also on domestic freezings and holdings of fishery products, production of fish meal and oil, documentation of fishing vessels, and United States foreign trade in fishery products. Quarterly reports on the yield of fish sticks and annual bulletins on the production of canned fishery products, byproducts, and packaged fish were released.

A study was started to develop means of improving the collection and publication of statistics on freezings and cold-storage holdings of fishery products. To obtain needed information on the South Atlantic and Gulf shrimp fishery, our most important fishery in value of catch, collection of detailed operating-unit and catch statistics was undertaken.

To aid in the orderly marketing of fishery products and byproducts, marketing specialists in fishing, distribution, and consumption centers collect daily production and marketing information. This information is disseminated while it is timely and current, through daily reports by the seven Fishery Market News Service field offices located in Boston, New York City, Hampton (Va.), New Orleans, San Pedro, Seattle, and Chicago. Market News "Fishery Products Reports" provide a 17-year daily record of fishery production, marketing, and price data. These reports are used extensively in the fishery industries, in conservation work, in granting loans, in supplying background data for governmental actions, in research, and in determining the economic importance of the fisheries. Keeping pace with changing marketing trends, more marketing information on consumer-packaged fishery specialties is now being collected and disseminated. Studies were begun on the marketing of fishery products in key consumption centers other than those now covered.

The monthly periodical, *Commercial Fisheries Review*, continued to feature articles and news of trends and developments in the fishery industries of the United States and foreign countries.

Regulatory activities and reports on fishery cooperative marketing associations were continued in accordance with the authority vested in the Department by the Fishery Cooperative Marketing Act of 1934. On June 30, 1955, there were 84 active fishery cooperative marketing associations in the United States and Alaska as compared with 81 a year earlier.

Studies were continued on fish consumption, including consumer preferences for fish sticks and breaded shrimp, increased express and railroad charges for icing shipments of fresh and frozen fish, and imports of groundfish fillets and tuna. A study of the economics of

distribution of Pacific coast fish in the Pacific Coast States was begun to determine (1) marketing practices and prices of different varieties of Pacific coast fish in the major Pacific coast consuming centers, and (2) the market potential for Pacific coast fish in the Pacific Coast States. The project will survey major fish markets in California, Oregon, and Washington to determine sources of supply, marketing channels, turnover of inventories, consumer preferences, and prices.

A survey was begun also of the fishing industry's hull insurance and protection and indemnity insurance problems. Rates and premiums have reached phenomenal levels in many segments of the industry. Vessel operations on all coasts have been hampered by this condition. Recommendations resulting from the project should lead to lower insurance costs for commercial fishermen.

A nationwide survey of merchandising practices in the shrimp industry has been started, aimed at improving production, processing, and distribution of shrimp products. Efficiency of vessels, motorboats, and processing plants will be studied by qualified engineers; time and motion studies will be undertaken with the intent of reducing costs of production. Transportation, warehousing, and refrigeration problems will be studied to improve the competitive position of the shrimp industry among the food industries.

MANAGEMENT OF THE ALASKA COMMERCIAL FISHERIES

In 1954 the commercial fisheries of Alaska, administered through the Fish and Wildlife Service, yielded products with a total value of \$78 million, as compared with \$70 million in 1953. The salmon fisheries which accounted for 88 percent of the total were severely curtailed in certain areas by regulatory measures designed to reserve more of the stocks for the spawning grounds and thus reverse downward trends in abundance. Patrol and stream-guard coverage was stepped up to ensure the success of this program. The total salmon pack in 1954 was 3,094,753 cases, down 12.18 percent from the 5-year average.

During the calendar year 1954, there were employed in the administration of commercial fisheries 29 fishery-management biologists and enforcement agents, 268 stream guards, patrolmen, and fishery aids, and 5 seasonal employees of the Alaska Department of Fisheries. Water transportation was provided by 7 seagoing vessels, 20 boats of smaller sizes, and about 150 outboard skiffs. Seven amphibian airplanes logged 2,630 hours of flight time.

In 202 cases involving violation of the Alaska fishery laws, of which 6 cases are still pending, 286 fishermen and 1 fish buyer were involved.

In cases disposed of, 277 defendants were found guilty, 2 were acquitted, and 7 were dismissed. Fines totaled \$32,035, of which \$2,885 was suspended. The cases involved 21 purse seines, 99 gill nets, 6 beach seines, 5 traps, 4 halibut boats, and 1 fish buyer. Jail sentences totaled 3,422 days, of which 3,232 days were suspended. Sales of confiscated fish netted \$4,929.96.

In addition to the above, 63 sport fishermen were involved in personal-use violations, 35 for snagging salmon, 14 for sport fishing for salmon in closed areas, 8 for exceeding the bag limit, and 4 others involved in combinations of the foregoing.

To determine the timing and size of the salmon runs, 25 weirs were operated in 1954; this was an increase of 1 from 1953. By area, 9 of these were operated in southeastern Alaska, 11 in central Alaska, and 5 in western Alaska. Weirs to count downstream migrants as well as migrant-sampling traps were again used to measure survival from spawning.

Pribilof Islands Fur-Seal Industry

In 1954, the Pribilof Islands fur-seal industry produced 63,882 fur-seal skins, 2,787 fewer than in 1953. The Provisional Fur-Seal Agreement of 1942 between the United States and Canada provides that 20 percent of the annual take of skins shall become the property of the Government of Canada. In 1954, 12,776 sealskins were shipped to the order of that country. In addition to skins, production on the islands included 330.5 tons of fur-seal meal and 41,396 gallons of oil. The meal and oil were sold later in the year by competitive bidding for a gross total of \$53,166.

Public auctions of United States Government-owned fur-seal skins were held in St. Louis, Mo., twice during the fiscal year. On October 18, 1954, 26,590 skins were sold for \$2,045,346, and on April 25, 1955, bidders paid \$2,296,757 for 24,746 skins.

MAINTAINING THE INLAND FISHERIES

Major emphasis in the past year was placed on the management of waters, through close cooperation with the States, in such a manner as to obtain the greatest return of hatchery-reared fish to the creel. The Fish and Wildlife Service operated 89 hatcheries, where 24 species of fish were propagated for distribution to inland waters. The Service liberated a large percentage of these fish in waters on Federal land, near military installations and veterans hospitals, and on State-Federal management areas. The fishing pressure on game fishes continued to mount, reflecting the demands of an increasing population and a growing appreciation of the sport of fishing as a source of relaxation and recreation. Improved fish-cultural tech-

niques were largely responsible for an increase in the weight of fish produced for stocking, and better management made possible more efficient utilization of the product.

As more information became available on the restocking needs of management areas, the production of certain species was expanded; in many instances, the production of the larger, more efficient units was increased to meet the needs of the areas concerned. The production of legal-sized trout was an important part of the program; the need for warm-water species remained high; and the maintenance of salmon runs continued to be of major importance.

Congress provided funds for initiating an improvement program at the Inks Dam (Texas) station and for continuing the construction of a new unit at Frankfort (Kentucky), as well as for repairing flood damages at the Craig Brook (Maine) station.

The lower Columbia River fisheries development program, designed to mitigate the damage caused by Federal and other dams to the salmon fisheries of the river, completed the seventh year of operation with significant results apparent. Major fishways completed in several lower Columbia River tributary streams permit adult salmon to pass upstream to many miles of spawning area heretofore inaccessible to the salmon.

Two salmon hatcheries were completed, one in Washington and one in Oregon, and other projects under construction were continued. Some 50 irrigation diversions were screened to prevent entrance and loss of young salmon.

The program of providing maximum spawning area for salmon in the lower Columbia River is producing results. Biologists have observed increased spawning activity and greater numbers of young salmon. The full results of the program will not be apparent for a number of years.

More than 18.5 million angling licenses were sold in the 48 States in 1954. This was a gain of more than 5 percent over the previous record year and $2\frac{1}{2}$ times the number sold in any year before 1946. Greater numbers of legal-sized trout were produced at Federal hatcheries to maintain the stock of these popular sport fishes in areas where the pressure is so great that native stocks have been depleted. The studies on trout nutrition and the training program for trout culturists were continued at the Cortland (New York) fish-cultural station in cooperation with the State of New York and Cornell University. These activities played an important part in decreasing the cost per pound of trout produced at Federal and State hatcheries throughout the country. The increased production of trout at a number of hatcheries with expanded rearing facilities was of particular importance in the past year; the incidence of disease in trout stocks was held below normal.

Drought conditions in the central and southern regions of the country emphasized the importance of small ponds and reservoirs. Increased pond construction brought increased demand for warm-water fish to stock the ponds. Eradication of rough fish from large water impoundments and even from entire watersheds also increased the demand for warm-water fish, especially predator species. The Service received a record number of applications for bass and bluegill during the year, and the demand for pike and channel catfish far exceeded the production. In cooperation with the States, the Service stocked large impoundments in the Southwest with wall-eyed pike fry, a measure which contributed greatly to the value of the fishery. The training of warm-water fish culturists continued at the Marion (Alabama) station, and improved techniques in the control of pond weeds, fertilization, and management of rearing ponds formed part of the training program at this station.

The program of lamprey eradication in the Great Lakes is expected to make possible the restoration of the lake trout fishing through a concerted restocking effort on the part of the States, the Federal Government, and Canada. The Fish and Wildlife Service propagates lake trout at two hatcheries now, and additional facilities will be made available for rearing this species when the restocking program is fully effected.

The Branch of Game-Fish and Hatcheries has continued to employ a small staff of fishery-management biologists. The objective has been to improve fishing through the application of management techniques. Through extension-type services, these biologists have provided fishery-management guidance to numerous public agencies. The improvement of hatchery operations and fish-distribution programs has been a staff function of the biologists; their principal effort, however, has been directed toward planning and guiding cooperative fishery-development programs for waters on Federal-controlled areas. Fishery-management assistance to Federal areas—primarily Defense installations, Veterans' Administration hospitals, national forests, Indian reservations, and wildlife refuges—has been a notably popular and successful venture. Currently more than 200 Federal installations are being assisted.

Demands for hatchery fish continue to exceed the productive capacity of State and Federal hatchery systems. Hatchery production is undergoing changes to meet the requirements imposed by continuously growing sport-fishermen pressure, construction of farm and ranch ponds and great reservoirs, and development of new cooperative management areas and fishery-management techniques. To some extent, these changes are reflected in data on production and distribution, summarized in the attached tabulations.

TABLE 1.—*Fishes and fish eggs distributed: Calendar year 1954*

Species	Eggs (num- ber)	Fry (num- ber)	Fingerlings		Fish 6 inches or larger		Total weight finger- lings and larger	Total number fish and fish eggs
			Number	Weight <i>Pounds</i>	Number	Weight <i>Pounds</i>		
Largemouth bass.....		374, 500	11, 328, 090	24, 752	15, 190	2, 274	27, 026	11, 717, 780
Smallmouth bass.....		522, 000	204, 220	700			700	726 220
Bluegill ¹			12, 881, 340	30, 822	8, 570	1, 381	32, 203	12, 889, 910
Redear sunfish.....			1, 793, 370	4, 436	40	17	4, 453	1, 793, 360
Black crappie.....			50	5	500	235	240	550
Channel catfish.....		315, 000	600, 200	3, 686	8, 470	786	4, 472	923, 670
Bullhead.....			260, 680	462			462	260, 680
Walleye.....		2, 520, 000	1, 065, 340	1, 473	20	2	1, 475	3, 585, 360
Northern pike.....	2, 865, 000	7, 781, 920	111, 430	469	1, 240	37	506	10, 759, 590
Cutthroat trout.....	860, 700		523, 680	7, 230	31, 280	4, 840	12, 070	1, 415, 660
Rainbow trout.....	6, 358, 380		5, 764, 600	62, 910	2, 323, 500	459, 652	522, 562	14, 446, 480
Kamloops trout.....			49, 940	2, 485	34, 150	2, 853	5, 338	84, 090
Beardsley trout.....			16, 360	38			38	16, 360
Steelhead trout.....			231, 630	8, 383	48, 360	6, 872	15, 255	279, 990
Lake trout.....			863, 100	8, 965	1, 000	32	8, 997	864, 100
Brook trout.....	7, 239, 500	260, 000	2, 987, 840	34, 208	929, 720	182, 988	217, 196	11, 417, 060
Brown trout.....	2, 884, 730		1, 984, 760	13, 617	459, 100	97, 834	111, 451	5, 328, 590
Grayling.....	428, 800	350, 000						778, 800
Chum salmon.....	500, 800	8, 527, 400						9, 0 8, 200
Coho salmon.....	556, 750	150, 940	1, 054, 720	11, 936	94, 510	6, 444	18, 380	1, 856, 920
Sockeye salmon.....	913, 950		3, 704, 840	20, 748	36, 150	1, 214	21, 962	4, 654, 940
Kokanee.....			983, 970	237			237	983, 970
Chinook salmon.....	20, 360, 950	298, 520	73, 564, 240	364, 147			364, 147	94, 223, 710
Atlantic salmon.....		87, 760	260, 750	4, 306	3, 180	264	4, 570	351, 690
Total.....	42, 969, 560	21, 188, 040	120, 235, 100	606, 015	3, 994, 980	767, 725	1, 373, 740	188, 387, 680

¹ Approximately 10 million bluegill, weighing 10,000 pounds, have been distributed but not recorded at the time of this report.

TABLE 2.—*Land acquired or in process of acquisition for fish-cultural stations, fiscal year 1955*

[In acres]

State and station	Acquired			Pending title con- veyance
	By other than pur- chase	By pur- chase	Total	
Georgia: Warm Springs.....		1	1	
Nebraska: Crawford.....		1	1	
Oregon: Eagle Creek.....	600		600	
Washington: Spring Creek.....				6
Total.....	600	2	602	6

RESEARCH IN FISHERY BIOLOGY

Coastal Fisheries

Using methods developed in its 5-year study of the Atlantic coast shad, the Service was able to predict Connecticut and Hudson River shad runs within 15 and 3 percent, respectively. Recommendations for regulations to conserve these fisheries have been made through the Atlantic States Marine Fisheries Commission, and catches and spawning escapements are both increasing. With this year's investigation of the Edisto River in South Carolina, surveys of all the major Atlantic coast shad streams have been completed.

New fish facilities at Holyoke Dam on the Connecticut River have proved successful. After a century's absence, shad in substantial numbers this year reached their ancestral spawning grounds above the dam, with a total of almost 5,000 counted through. Design of the fishways was a cooperative enterprise of the Service and the Holyoke Water Power Co.

The Service has continued to act as coordinator of the Atlantic coast cooperative striped bass program, in which 10 States now participate. Greatest progress has been in identifying stocks of the fish; current work covers continuation of stock identification, plus studies of spawning, migrations, and life history.

To find the reason for poor survival of Atlantic salmon in recent years, biologists are making a thorough study of environment in the Sheepscot River and its estuary in Maine. It has been found that the river exerts but slight influence on its lower estuary, indicating the importance of marine climate to estuarial survival of Atlantic salmon.

A new method of evaluating brood size has been developed to improve forecasts of Alaska pink salmon abundance: The young salmon, newly migrated to salt water from their natal streams, are enumerated as seen in the many fish traps along the shores. This method should prove much more accurate than the counts at stream mouths formerly used, since much of the widely fluctuating marine mortality has already occurred by the time salmon are big enough to be found in traps.

Encouraging results have been obtained from the experimental fertilization of a small lake (Bare Lake) on Kodiak Island, Alaska, to increase red salmon production. The 1955 downstream migration of young red salmon was the largest on record, and the fish were longer and heavier than those of previous years.

Activities related to the International North Pacific Fisheries Commission have extended the investigation of the marine life of the salmon. Five research vessels (*John N. Cobb*, *Paragon*, *Mitof*, *Memento*, and *Starling*) operated by the Service, by charter, and by contract to the University of Washington, are covering thousands of square miles of North Pacific Ocean in the vicinity of the Aleutian Islands and the Alaska mainland, in a study of distribution, abundance, and identity of oceanic stocks. Samples for comparison with high-seas fish are being taken along the coast from the Aleutian Islands to the Columbia River.

In the Columbia River, electrical means of guiding salmon safely over dams are being further developed. The first crude field-scale models of electrode arrays are being refined to increase the percentage of fish guided and to decrease mortality. Electrical devices to kill predatory fish, or to keep them out of critical areas (like hatchery

release points) have been proved feasible and are being further developed.

At Bonneville Dam a research facility to solve salmon fishway design problems is being built in cooperation with the United States Army, Corps of Engineers. This structure will provide a flume 24 feet wide, 24 feet deep, and 104 feet long, for the solution of biological problems of fish passage through full-scale fishway models.

Shellfisheries

Clam investigators in New England continued to apply major effort to the problem of the predatory green crab, cause of the decline in soft-clam production. On the advice of biologists, towns in Massachusetts and New Hampshire built clam fences this year.

Studies of hard clams (quahaugs) in Rhode Island showed a decline in abundance last year, and efforts are being made to find the cause.

Oyster investigations in the New England, Chesapeake Bay, and Gulf of Mexico areas continued to supply needed information to growers. With funds available under the Saltonstall-Kennedy Act, new studies of oyster predators were started to develop techniques of eradication or control. Part of this work is being carried out by contract with universities and State fishery agencies.

Inland Fisheries

The Great Lakes Fisheries Convention was ratified by the United States and Canada in June 1955, and the Commission may be operating within the next year.

Control structures operated up to June 30, 1955, indicate that the adult sea lamprey population in Lake Superior has more than doubled since 1954. Abundance in Lakes Huron and Michigan continued to be high.

In a 4-year search for methods to control the sea lamprey in the Great Lakes, electrical and mechanical devices have been developed that are economical and effective in blocking spawning runs of adult lampreys.

In search for chemicals lethal to larval lampreys but innocuous to fishes, about 5,000 compounds have been tested and 8 show promise. Their toxicity is under study to determine their margin of safety to aquatic animals; field tests will follow.

The research vessel *Cisco* completed fishery-limnological surveys of southern Lake Michigan in November 1954, and began a similar program in northern Lake Michigan in May 1955. These surveys permit a comparison of the present stocks of fishes and the present

ecological structure with those of 1930-31 when the last survey was conducted. The lake trout is nearing extinction in Lake Michigan. Only 7 lake trout were taken in 1½ million linear feet of gill net in April and May of 1955; in 1930-31, 16,200 were taken in the same amount of net. The commercial chub catch increased from about 2 million pounds in the early 1940's to 11 million in 1953.

The probable source of the virus infection of blueback salmon that caused serious losses in hatcheries the last few years was the viscera used in the diet. The viscera were eliminated from the diet in the 1955 rearing season and no virus disease appeared. Experiments are under way to make viscera usable as a cheap hatchery food.

Studies on bacterial diseases of fishes are being continued by Service microbiologists and histopathologists. Several diseases have been identified; new methods of treatment are being tried, and several new drugs appear promising. Search for disease-resistant strains of trout is under way at Leetown, W. Va.

The Service is continuing the fishery research on Yellowstone Lake, in Yellowstone National Park, one of the most productive lakes in the United States, famous for its wonderful black-spotted trout (cut-throat) fishing. For several years the average catch per angler and the average size of the fish became progressively smaller. This decline accompanied increase in the number of park visitors, with consequent increase in fishing pressure. More than 200,000 people fish the lake each year; in addition, large native populations of pelicans, ospreys, cormorants, bear, otter, etc., feed largely on fishes of Yellowstone Lake.

Studies begun in 1950 have revealed that the trout population is composed of a number of separate races, each of which spawns in a particular stream. Depletion falls heaviest on a few races because anglers have concentrated at two points on the lake. Experimental regulations were placed in effect, shortening the fishing season and lowering the creel limit. In addition, trout eggs and fry were no longer collected at the lake for shipment to nearby States; instead, all fish were allowed to spawn naturally.

Several years' study will be required to measure how much the regulations affect abundance. Early results indicate that the decline has stopped. Studies will also be undertaken to determine the factors that make Yellowstone Lake extremely productive; if these can be determined, it may be possible to improve the productivity of other bodies of water.

Marine Fisheries

The regulation requiring a minimum mesh of 4½ inches in the cod ends of otter trawls fishing for haddock on New England banks has proved highly successful. Large-mesh nets are releasing baby had-

dock precisely as had been predicted on the basis of experiments by the Woods Hole, Mass., laboratory. Furthermore, they have proved so efficient in capturing larger sizes of fish that they have found wide acceptance in the fishing industry. The International Commission for the Northwest Atlantic Fisheries at its 1955 annual meeting recommended extending regulation of mesh size to Nova Scotian and Newfoundland banks. The 1952-year class of haddock has proved to be highly successful, and 3-year-old haddock are now abundant on Georges Bank. This year class will provide an excellent opportunity to test the conservation benefits of the 4½-inch mesh, since large numbers of this group should have escaped capture during the 1954 season.

With funds provided under the Saltonstall-Kennedy Act, research was begun on Atlantic herring, yellowtail flounder, whiting, and sea scallop; research on ocean perch (redfish) was expanded. Initial studies have shown that small whiting will escape unharmed through meshes of a cod end of trawl nets; conservation of this species will be possible through the use of nets with the proper mesh.

Atlantic-coast menhaden studies were commenced under the Saltonstall-Kennedy program. The menhaden is the object of the largest fishery in America. Biologists have been stationed at the main fishing centers to obtain information necessary for determining the success of annual broods. First results from surveys indicate that menhaden are shore-bound fish which require the environment of the bays and inshore waters along the Atlantic coast.

Two years of cruises along the South Atlantic coast by the research vessel *Theodore N. Gill* were concluded in December 1954, and this vessel was transferred to Maine for herring investigations. Analysis of data on numbers of fish eggs and larvae indicates that the most productive areas south of Cape Hatteras are on the inner shelf adjacent to mouths of rivers.

Studies of the red tide along the west coast of Florida were continued. Field surveys revealed the presence of *Gymnodinium brevis*, the red tide organism, in low numbers through the winter of 1954-55. Experiments show that copper in concentrations of .05 parts per million is lethal to *G. Brevis* and is the best known control chemical now available. Experiments in the laboratory, where *G. Brevis* is now maintained in culture, show that a delicate balance between sulfur compounds and copper may be the key to red-tide outbreaks in Florida waters.

Shrimp research in the Gulf of Mexico has been expanded through the Saltonstall-Kennedy program. Initial studies on shrimp tagging and a study of shrimp anatomy are under way by contract with two Gulf universities.

Analysis of data collected by the research vessel *Alaska* on cruises in the Gulf of Mexico indicates that carbohydrates are sometimes more

concentrated below 200 meters than at the surface, and that photosynthetic activity probably takes place at those dark depths; this suggests that an abundance of fish might occur there.

A change of sea conditions caused the Pacific sardine to spawn in greater numbers off California than in several years. About 230,000 tons of fish (2.3 billion individuals) were off southern California during the 1954 spawning season. The increased abundance resumes a pattern that had been interrupted for at least 2 years.

Anchovy larvae were more abundant in waters of California and Mexico in 1954 than in earlier years. The 1953 and 1954 year classes of anchovy appear to be partially successful. Pacific mackerel larvae were in southern California waters in greater numbers than in recent years and the partial return of this species parallels that of the sardine.

A census of the California gray whale was taken from Point Loma and La Jolla, Calif., as the whales passed southward to Baja California lagoons to calve and breed. The estimate was 4,500 whales.

Records of Japanese fisheries operations and the Pacific oceanic fishery investigations fishing show that when fishing is poor at the longitude of Christmas Island, better fishing is to be had to the east or west. This suggests that Central Pacific yellowfin tuna stocks move about in response to changes in the environment. On the average, the vicinity of Christmas Island supports the densest population of yellowfin. The average distribution of yellowfin has been found to agree with distribution of animal plankton.

Studies of the identity of tuna stocks of various parts of the Pacific suggest that along the equator yellowfin are relatively nonmigratory. This is an important factor in determining effects of fishing on Pacific tuna stocks.

Initial surveys of the albacore of the North Pacific, started under the Saltonstall-Kennedy program, have been completed. In the fall of 1954, large numbers of small to medium sized albacore were found associated with the transition between the sub-Arctic and North Pacific waters. Albacore were found in considerable numbers in the area between 180° and 160° W. and 30° to 37° N. during the winter and spring months although they were not in sufficient abundance to support an American commercial fishery.

MANAGEMENT OF WILDLIFE

Again this year the game-management program of the Service emphasized cooperation with the States. This coordinated effort involved both the technical phases aimed at better understanding of

the biology of migratory birds, and public relations and public education to strengthen support of the regulatory program.

This year 17 States participated in an enlarged waterfowl-banding program in Canada; this compared with 11 States last year. Banding is essential to a clear understanding of the migration patterns of waterfowl, and information from banding will soon permit more definitive regulations. The extremely favorable water conditions in Canada, which permitted a bumper crop of birds, lessened the opportunities for a thoroughly effective trapping and banding program; but a great deal was accomplished, particularly in the Maritime areas where for the first time a sizable banding program was initiated.

Our cooperative ties with the States were strengthened by a series of May and June meetings of technical and administrative personnel in all 48 States as they are represented in the Flyway organizations. In these meetings across the country the regulatory program of the Service was reviewed well in advance of the August meeting at which regulatory revisions for the current year are proposed.

During the year, 207 cases involving violations of the Alaska game law were concluded, in addition to 5 cases involving the Migratory Bird Treaty Act and 2 of the Migratory Bird Hunting Stamp Act which were disposed of in Alaska. Fines aggregated \$18,412 (of which \$2,403 were suspended); jail sentences totaled 1,862 days (of which 1,802 days were suspended). Seizures included 43 firearms, 73 traps and snares, 16 game birds, 254 fishes, 80 game animals, 36 skins of fur-bearing animals, 2 shotguns, 1 net, 1 ax, and 1 knife, and 68 hunting and fishing licenses.

In addition to the violation cases concluded in Federal courts, United States game management agents (acting as deputy State game wardens) individually, or in cooperation with State game law enforcement officers, assisted in the apprehension and conviction in State courts of 5,485 persons charged with violations of State game and fish laws, resulting in imposition of fines and costs aggregating \$148,345.66. Of these cases, 2,971 involved the unlawful taking of migratory birds and interstate shipments of game animals and fish which were subject to prosecution in Federal courts under applicable Federal laws.

Game management agents of the Service continued to cooperate extensively with law-enforcement officers of other Federal agencies and State agencies in fish and game resource conservation. An example of this type of cooperation is the assistance by a Service agent to rangers of the National Park Service in the apprehension and prosecution of 8 individuals for taking overlimits of trout in Yellowstone National Park, resulting in fines aggregating \$270. In Louisiana a Service agent, with State law-enforcement officers, assisted the United

States Forest Service in apprehending 5 individuals and obtaining conviction in Federal court for hunting and possessing deer on a Forest Service game management preserve during closed season. Fines and sentences aggregated \$600 and 300 days in jail (of which 180 days were suspended), and 15 years' probation. In other actions, 18 persons were apprehended for transporting firearms within the preserve; 9 were convicted in Federal court, resulting in fines aggregating \$900, suspended jail sentences totaling 540 days, and 45 years' probation. Of the rest of these cases, 8 were declined prosecution by the United States attorney because of extenuating circumstances and 1 case was pending at the end of the fiscal year.

A Service agent cooperated with officials of the Bureau of Customs at Miami, Fla., in the recovery of 44 spotted-breasted orioles which had been allowed entry without realizing that they were one of the numerous species protected by the Migratory Bird Treaty Act. These birds had been shipped from Nicaragua and were intended for the caged-bird traffic. No action was taken against the importer since he apparently had acted in good faith and had been misled through misrepresentations by the exporter. The birds were repossessed and donated to a municipal zoo.

At the end of the fiscal year the following most common migratory-bird permits were in effect: Propagating 3,414; scientific collecting, 1,641; bird banding, 3,588. Individual actions involving the issuance of new permits, renewals, cancellations, revocations, and amendments in connection with these permits and others, excluding bird-banding permits, totaled 3,492.

During calendar year 1954, 10,223 ducks and 1,762 geese were sold by permittees for propagating purposes; 14,252 ducks and 575 geese were sold for food; and 16,534 ducks and 777 geese were liberated. On December 31, 1954, migratory waterfowl involving a total of 50,498 of all species were being held in captivity for propagating purposes. Reports from permittees revealed that 724 wild doves and 83 band-tailed pigeons were being held for experimental breeding purposes. For scientific purposes, 17,318 migratory birds, 18 sets of eggs, and 2,275 eggs not in sets were collected. Although permittees are allowed to collect specimens of migratory birds and their eggs for scientific purposes, the permits require that all specimens which can be preserved shall ultimately be donated to a scientific or educational institution.

Under regulations pursuant to paragraph 1518 of the Tariff Act of 1930, as amended by the act of July 17, 1952 (66 Stat. 755, 19 U. S. C. sec. 1001, par. 1518), 18 permits were issued to authorize the entry, under quota, of skins bearing feathers of certain species of foreign wild birds. Imports were as follows: Pheasant skins, 4,000; gray

jungle fowl skins, 2,470; mandarin duck skins, 101. The skins of gray jungle fowl and mandarin ducks were for use in the manufacture of artificial flies for fishing while the pheasant plumage lawfully may be used for millinery as well as for fishing flies.

TABLE 3.—*Cases disposed of in Federal Courts (exclusive of Alaska) involving violations of wildlife conservation laws administered by the Fish and Wildlife Service, fiscal year 1955*

	Pending July 1, 1954	New cases	Pending June 30, 1955	Terminated	Fines and costs	Jail sentences (days)	Probation (days)
Migratory Bird Treaty Act.....	127	1,093	266	¹ 954	\$50,909	1,649	18,250
Migratory Bird Conservation Act.....	21	41	13	² 49	760	420	7,665
Migratory Bird Hunting Stamp Act.....	11	32	8	35	1,240	360	12,775
Lacey Act.....	3	-----	1	2	2,000	-----	-----
Black Bass Act.....	2	-----	-----	2	1,600	60	730
Northwest Atlantic Fisheries Act.....	8	2	5	5	430	-----	-----
Halibut Act.....	1	2	-----	3	650	-----	-----
Upper Mississippi River Wild Life and Fish Refuge Act.....	-----	3	-----	3	75	-----	-----
Assault Act.....	-----	9	5	³ 4	-----	-----	-----
Total.....	173	1,182	298	1,057	⁴ 57,664	⁵ 2,489	⁶ 39,420

¹ Of the 954 cases involving violations of the Migratory Bird Treaty Act terminated in Federal courts during the fiscal year, 765 represent convictions resulting in fines, costs, and jail sentences as reflected under the appropriate column headings, 2 were closed because of the deaths of the defendants, 25 defendants were adjudged not guilty, 41 were dismissed, 8 were disposed of without prosecution following a warning by the United States attorneys, and 113 were closed without prosecution because of insufficient evidence or extenuating circumstances which warranted withholding of prosecution.

² Of the 49 Migratory Bird Conservation Act cases terminated, 24 represent convictions resulting in fines, costs, and jail sentences as reflected in the appropriate column headings, 2 defendants were adjudged not guilty, 17 cases were closed without prosecution because of insufficient evidence, and 6 cases were not prosed.

³ These cases were closed without prosecution because of insufficient evidence.

⁴ Includes \$425 suspended.

⁵ Includes 2,133 days suspended.

⁶ Includes 365 days suspended.

WILDLIFE RESEARCH

Wildlife research is of necessity a continuing program. New useful facts are still to be learned about all species; old ideas need constant reappraisal to assure continued effectiveness under changes brought about by a rapidly increasing human population. Superficially, studies of the same species year after year may seem repetitious; actually, promising leads for investigation are seldom wanting, so diverse are the contacts of wildlife with human activities.

Public land-management agencies are seldom free of wildlife problems that, according to interagency cooperative agreements, should have the attention of Service research biologists. In the Pacific Northwest, direct seeding of Douglas-fir and other conifers offers the main hope for perpetuating great forest industries, but woods mice and other small rodents, by eating the seeds, are blocking reforestation. In the search for a satisfactory repellent, hundreds of chemicals have been tested, and more than 40 research scientists in almost as many organizations contributed valuable tree seed, experimental chemicals,

manpower, equipment, and even funds, to support the project centered at the Wildlife Research Laboratory in Denver. In Oregon a population of deer mice is being studied intensively in a logged, burned, and poisoned Douglas-fir area to determine the effectiveness of control measures.

Direct seeding is similarly important in southern pine forests from Virginia to Florida and east Texas, but here birds migrating into the area in large numbers and eating newly planted seeds have caused many failures. For the past 3 seasons Service biologists have cooperated with foresters of the Southern Forest Experiment Station to study bird repellents. During the unfavorable 1954-55 longleaf-pine planting season in central Louisiana, each of 3 chemical treatments protected seedlings in direct-seeded plots while untreated plots were severely damaged by birds.

Repellents to reduce blackbird depredation in rice, corn, and other crops are being investigated, but for the present the use of frightening devices and a change in plant varieties or planting time have given most relief. The rope firecracker in particular has often provided economical protection. Wholesale blackbird reduction advocated by some whose crops are damaged is impracticable because of the tremendous range and numbers of the various blackbird species. Local reductions may prove feasible if data now being accumulated show depredations to be mainly from resident flocks.

Repellents that will keep rabbits, deer, rodents, and other wildlife from damaging not only direct seedings but forest plantations, orchards, shelterbelt plantings, and agricultural crops are important alike to farmers, foresters, and wildlife managers. Recent laboratory and field tests demonstrated the value of several new compounds. Field tests in the Northwest showed 30 to 87 percent of untreated Douglas-fir seedlings were damaged. Similar success was achieved in the Plains States with Chinese elm and other tree and shrub species used in game-cover and shelterbelt plantings. Although these tests give cause for optimism in some cases, in others, costs of application may be prohibitive. In Montana, reforestation difficulties center around the preference of deer, squirrels, mice, hares, and other animals for ponderosa pine over less valuable tree species. By eating seeds, cutting cones, nipping seedlings, and in other ways, these animals can prevent pine predominance in timber stands, thereby causing serious economic loss. In the Lake States, similar problems occur; in the Northwest, bears girdle maturing Douglas-fir trees; countrywide, porcupines are the bane of foresters. In extensive areas, repellents seem to have little to offer. On the other hand rodent repellent treatments for packaged goods, a subject of tremendous interest to food producers and handlers, show promise. Commercially

prepared boxes have been made for field evaluation, and some of the compounds have been incorporated in electrical insulation, plastics, and fabrics, a program being supported by the Quartermaster Corps.

Insecticides are used at the rate of some million tons a year, and some of them affect wildlife adversely. Tests at the Patuxent Research Refuge showed that although ill effects were not apparent from feeding small, nonlethal doses of DDT to quail for a period of several weeks, reproduction was markedly reduced and chicks from these test birds failed to survive even though fed no DDT. In a different phase of the insecticide story, mosquitoes are exhibiting a growing resistance to DDT and related insecticides and consequently are giving impetus to the drainage of wetlands as a control measure; this in turn conflicts with waterfowl-conservation efforts. Cooperative studies with the Department of Agriculture and several State agencies are under way to gather biological information as the first step in resolving such conflicts.

Loss of waterfowl breeding and nesting grounds makes imperative the improvement in quality and productivity of remaining marshes. Waterfowl habitat research has been concentrated on (1) controlling weedy marsh plants, and (2) managing water supplies better. Small-scale tests with new herbicides and adjusted water levels have shown methods by which cattails, reeds, and needlerush may be controlled. These methods applied on a large marsh in Delaware have helped to convert it into one of the most attractive areas for waterfowl on the north Atlantic coast, and similar demonstrations are being arranged elsewhere through State cooperation.

Of particular interest in marsh management is the nutria (*Myocastor coypus*), a large rodent imported from South America for its potential value as a fur bearer. A cooperative study with the Louisiana Wild Life and Fisheries Commission provides information about molting and priming of the fur, relationships to muskrats and other marsh dwellers, and effects on marsh vegetation.

Other fur-animal investigations have dealt mainly with sea otters and fur seals, particularly the food habits of these animals as they relate to commercial fisheries. Canadian, Japanese, and United States representatives at a meeting in Tokyo in November 1954 completed a joint report of the investigations made in 1952 in the North Pacific of the distribution and food habits of fur seals. In 1954, on the Pribilof kill fields, where chances of taking stomachs containing food were less than one in a thousand, 27 were obtained. The contents, 94 percent of which was the sandfish *Trichodon*, contained no commercial fish species except 2 small cod. In June 1955, a study was begun of the pelagic feeding habits of the seals with particular reference to the salmon gill-net fishery.

Mortality of fur-seal pups from hookworm is appalling, amounting in 1954 to nearly double the 63,882 animals taken for pelts. To reduce this loss a soil treatment to kill hookworm larvae is being sought. A 5.5-acre test of creosol and cresylic acid compounds decreased the number of larvae, but pup mortality was not appreciably reduced. A smaller test of 3 borax compounds was made, but effectiveness will not be known until the summer of 1955.

Under current policy the number of bull seals spared appears adequate to maintain a high ratio of pregnancy among sexually mature females. Even so, a study of the age and reproductive condition of 607 females from rookeries and 625 from hauling grounds showed that about 20 percent of the females bear their first pup in their sixth year.

A project to reestablish sea otters in former habitat made doubtful progress when 19 survivors out of 28 captured on Amchitka were released at Otter Island in the Pribilofs on April 9, 1955. Of these, 3 succumbed in the ice-packed waters. The fate of the remaining 16 should be known this summer.

Addition of a permanent investigator and several seasonal assistants gave impetus to avian botulism research, at Bear River in Utah and Tule Lake in Oregon. No major outbreaks occurred in 1954, but studies of hospitalization practices, limnobiology, and detection of toxic areas, as well as bacteriological tests of *Clostridium botulinum*, type C, continued in cooperation with the Rocky Mountain Laboratory, Public Health Service. Continued research on Canada geese at Pea Island Refuge revealed that the gizzard worm is a serious hazard to their survival there. Infective larvae of this parasite have been identified, and their period of development into an adult state in goslings has been found to be as short as 14 days. Infections of gizzard worms and flukes, which were thought to take place only on breeding grounds, were found to occur at the refuge during the winter. At Patuxent Research Refuge, where *Trichomonas gallinae* infections in mourning doves have been higher than in previous years, the susceptibility of native birds other than doves to this parasite is being tested.

Bird banding is yielding more and better information essential to the realistic management of important migratory game birds. About 176,000 birds were banded during the year, with special attention to migration of the mallard and mourning dove. Research continued on the effects of hunting and other depletion factors on dove populations. To learn more about the habitat necessary to support breeding and wintering waterfowl, intensive studies of environment and food supply were conducted in the Chesapeake Bay area. A technique of censusing woodcock by recording the calling males under measured and uniform conditions in sample areas is being tested in cooperation

with 238 State and university biologists in 16 States and 3 Canadian Provinces. A method of measuring fluctuations in Wilson Snipe populations also is being studied.

An important accomplishment in wildlife literature was the issuance of Wildlife Abstracts, 1935-51, a 435-page book which annotates publications abstracted in Wildlife Review, Nos. 1 through 66. As the only compendium of the kind in the wildlife field, it should prove helpful to all organizations and individuals concerned with wildlife management and conservation.

The Cooperative Wildlife Research Units, which the Fish and Wildlife Service, the Wildlife Management Institute, land-grant colleges, and conservation departments of 16 States and Alaska operate as partners, continued their program of research, training, and conservation education.

During the 1953-54 school year, 202 wildlife students, including 71 with advanced degrees, were graduated. More than a fourth went into military service; 15 percent returned to school for further training; others obtained positions with State and Federal conservation agencies or educational institutions. Since the units were established, more than 2,200 wildlife majors have been graduated from the unit schools, and many have advanced to key positions in the field.

Research was conducted by unit personnel on waterfowl, fur and game animals, habitat improvement, and many other phases of wildlife management. Results of completed projects were summarized in 129 publications which received wide distribution. These, together with lectures, radio and TV broadcasts, and hundreds of letters written in reply to requests for wildlife information, provided facts useful both to wildlife technicians and the public.

MAINTAINING THE NATIONAL WILDLIFE REFUGES

Although there has been little in the way of direct appropriations for acquisition and development of new refuge areas since 1940, the Service has continued to make some progress in expanding the refuge system, largely through the use of suitable areas acquired by other Government agencies for other public purposes.

In the past, refuges were superimposed on 23 reservoir projects of the Bureau of Reclamation, 5 projects of the Corps of Engineers, 2 of the Tennessee Valley Authority, 2 of the Bureau of Indian Affairs, 1 of the State of Tennessee, and 1 of the South Carolina Public Service Authority. Recently, the 204,000-acre Stillwater National Wildlife Management Area was established in Nevada on lands of the Truckee-Carson irrigation district, while the 141,000-acre Loxahatchee National Wildlife Management Area was created on lands con-

trolled in part by the central and south Florida flood control district.

During this fiscal year, the 10,800-acre Kirwin National Wildlife Management Area in Phillips County, west-central Kansas, was established on a Bureau of Reclamation impoundment. This is the first Federal refuge in that State. The Kirwin Management Area is strategically located in the Central flyway, lying between the refuge areas of western Nebraska and the famous Salt Plains National Wildlife Refuge of north-central Oklahoma. Both ducks and geese will utilize the area, although management for geese will be of primary importance because of the critical habitat situation for these birds in the Central flyway. It is expected that the Kirwin vicinity will become one of the best waterfowl shooting sections of Kansas. Under the provisions of a cooperative agreement signed last year, the Service assumes responsibility for the development of the recreational aspects of the area. Access roads, parking facilities, and picnic areas with tables, fireplaces, and comfort stations will be provided. Permits will be granted for boat rental and sale of bait to fishermen. Camping and trailer parking will be permitted.

A smaller refuge, in a critical area where land prices prohibited acquisition, was received as a gift to the Government. Mrs. Elizabeth Alexandra Morton Tilton of Southampton, N. Y., donated 112 acres of land at the eastern end of Long Island for establishment of a national wildlife refuge. A sandspit connects the refuge with the Long Island mainland. The property faces richly vegetated shoal waters which serve as an excellent feeding area for waterfowl.

Some land was purchased with Duck Stamp funds for two new refuges. An initial tract of 1,440 acres was secured in Stafford and Rice Counties, Kans., for the Quivira National Wildlife Refuge. In LaSalle Parish, La., 5,199 acres at the northeast end of Catahoula Lake will form the foundation of the Catahoula National Wildlife Refuge.

During the past 15 years this Service has been negotiating with the Corps of Engineers for the transfer of jurisdiction over wildlife on lands acquired by the corps within the limits of the Upper Mississippi River Wild Life and Fish Refuge. This area, extending for 284 miles along the river from Wabasha, Minn., to Rock Island, Ill., contains 197,444 acres in four States, and was established by act of Congress on June 7, 1924. Because of the extent of the area to be included, the limited funds appropriated for acquisition were expended only for tracts that owners were willing to sell. When the Corps of Engineers was authorized to establish the navigation project, the Service had purchased a number of scattered holdings along the river. Few of these were sufficiently consolidated to be satisfactorily managed for waterfowl. By agreement with the Corps of Engineers, the Service discontinued acquisition of lands with the understanding that the

remaining lands to be acquired would eventually be made available to the Service for wildlife purposes, in return for which Service lands would be available to the corps for navigation purposes.

Inasmuch as it would have been economically infeasible and unnecessary to prohibit hunting on the acquired lands within the exterior boundaries of the Upper Mississippi Refuge, public hunting was allowed except in areas where there were sufficiently large blocks of land to serve as closed areas. Some of these units were selected wholly on the basis of size, regardless of their suitability for waterfowl management, and have so existed for many years. It was only recently that these negotiations were consummated and that the Fish and Wildlife Service has been in a position to select the better areas for intensive waterfowl management.

The Service is farming 98,925 acres to raise food for the hordes of ducks and geese that frequent the refuges. At certain times of the year about one-half of the continent's waterfowl population is dependent on these areas. During one period in December 1954, a total of 850,000 geese and 2,845,000 ducks were concentrated on three national wildlife refuges, one State refuge, and several hunting-club areas in the Sacramento Valley of California. To feed these birds and guard against their damaging adjacent ricefields, Service personnel in 1954 planted 2,441 acres of rice, millet, and barley, which produced over 100,000 bushels, on Sacramento, Colusa, and Sutter National Wildlife Refuges.

In addition to this vital function, the national wildlife refuges are a haven for picnickers, hunters, fishermen, photographers, and bird watchers. More than 5 million persons visited the refuges in 1954. Parts of 32 waterfowl refuges, with 527,207 acres, were open to shooting that year. Some of these were large areas like Tule Lake and Lower Klamath National Wildlife Refuges in northern California, Bear River Migratory Bird Refuge in Utah, and Upper Mississippi River Wild Life and Fish Refuge. In addition, 34 refuges with 2,100,000 acres were open for big-game and upland-game hunting. Bow-and-arrow hunting is gaining in popularity and was permitted on 10 refuges. The first archery season on wild turkey occurred on Bulls Island, within the Cape Romain National Wildlife Refuge in South Carolina, last year.

Waterfowl for tomorrow and continued opportunities for hunting them present a real problem. There were 25 percent more duck hunters during the past 5 years than during the 5 years preceding. If the duck populations hold out and if places to hunt remain available, provision will have to be made for 4 million duck hunters by 1975, or almost twice the present number. There are two great destructive forces now besetting the waterfowl resources—on the one hand the

number of hunters and on the other the accelerated destruction of waterfowl habitat in public and private ownership. Waterfowl habitat is being destroyed faster than conservation agencies can restore it.

The most effective method found for combating habitat loss is increased use of suitable lands on refuges for intensive crop production to feed ducks and geese. Other benefits to existing habitat are being secured through the eradication of pest plants, such as cattail, saltcedar, and noxious weeds. This work entails the use of aircraft for spraying and reseeding, power and hand spraying rigs of various types, and mechanical equipment for cutting or removing noxious plants. Loss of habitat through fire continues as a problem and reached disastrous proportions early in 1955 on the 329,110-acre Okefenokee National Wildlife Refuge in southern Georgia. A 3-year drought created an extremely serious condition in the swamp. In 1954, loss of 42,516 acres of timber resulted from 11 fires, 10 of them caused by lightning. Fires this year burned over 65 percent of the swamp with varying degrees of intensity. The policy, followed by the Service since acquisition of the area in 1937, of maintaining the swamp in a completely hands-off and natural condition, must now be relinquished to provide higher water levels. A much more effective fire-control organization, embracing the refuge and surrounding land, is now being organized.

The national wildlife refuges are constantly threatened by encroachments of various kinds. One group or another wants to take over or use the refuges for some kind of special or selfish interest. Expansion of military establishments has involved several refuges. A military public works bill included authorization for expansion of Fort Sill by transferring 10,700 acres of the Wichita Mountains Wildlife Refuge in southwestern Oklahoma. This area includes several lakes and one of the most intensively used recreational sections of the refuge. In 1954, more than 850,000 persons visited Wichita Refuge.

Military use on several other areas has been worked out under memorandums of understanding, with little damage to the refuges or disturbance to wildlife.

TABLE 4.—*Land acquired or in process of acquisition for wildlife conservation purposes under the Migratory Bird Conservation Act, by exchange, and by other acts of Congress, fiscal year 1955*

[In acres]

State and refuge	Acquired			Pending title conveyance
	By other than purchase	By purchase	Total	
California:				
Salton Sea				3
Sutter				118
Colorado: Monte Vista				1, 157
Florida:				
Chassahowitzka		16, 887	16, 887	
Loxahatchee		1, 327	1, 327	
St. Marks		18	18	
Sanibel		100	100	
Georgia: Piedmont		243	243	
Idaho: Deer Flat	280	59	339	80
Kansas: Quivira				1, 440
Kentucky: Reelfoot				250
Louisiana: Catahoula				5, 199
Maine: Moosehorn				1
Maryland: Martin	2, 482		2, 482	
Michigan: Shiawassee		2, 961	2, 961	94
Minnesota:				
Rice Lake		136	136	160
Upper Mississippi				404
Mississippi: Noxubee	1, 934		1, 934	603
Missouri: Mingo		14	14	
Montana:				
Fort Peck	43		43	
Red Rock Lakes	1		1	
New Jersey: Brigantine				48
New Mexico: Bitter Lake	80		80	
New York:				
Morton	112		112	
Wertheim				8
North Dakota:				
Lostwood		490	490	
Tewaukon		492	492	1, 333
Oklahoma: Salt Plains		80	80	
Oregon:				
Cold Springs	280		280	
Malheur		2, 686	2, 686	1, 670
South Carolina:				
Carolina Sandhills				51
Santee				72
Savannah				5
Texas: Laguna Atascosa		2, 278	2, 278	970
Vermont: Missisquoi				750
Virginia: Chincoteague				25
Washington:				
Columbia		185	185	41
Turnbull		5	5	
Wisconsin:				
Horicon		60	60	
Upper Mississippi	54	97	151	
Total	5, 266	28, 118	33, 384	14, 482

TABLE 4.—*Acres of public domain reserved for wildlife conservation purposes and administered by the States*

State and unit	Acres
Arizona: Gila River	6, 896
Colorado: South Platte River	120
Idaho: North Lake	2, 392
Utah: Topaz Lake	3, 662
Washington: Colockum	3, 695
Total	16, 765

FEDERAL AID TO STATES FOR THE RESTORATION
OF FISH AND WILDLIFE*Wildlife Restoration*

For the 17th consecutive year, the cooperative wildlife restoration program continued to pay a key role in the Nation's wildlife conservation efforts. Financial support for the program, from the excise tax on sporting arms and ammunition, amounted to \$10,266,257, a decrease of 15 percent from last year. Federal funds carried over enabled the net obligation by the States and Territories of \$11,153,472 in 706 projects. Improvement of wildlife habitat continued to be the principal interest. Studies to gather additional knowledge of wildlife management received substantial attention, as did acquisition of wildlife areas, maintenance of completed projects, and coordination of programs at the State level.

Reflecting the increasing interest in waterfowl restoration, every State undertook development of waterfowl areas last year to create nesting, feeding, or resting areas. Eight States performed construction work to create small marshes for ducks, while others worked on areas ranging up to 18,000 acres. Nineteen States, using captive goose flocks, are engaged in establishing or reestablishing goose concentrations where feeding and resting areas have been developed for these birds. Eleven States combined fisheries and wildlife restoration funds to create impoundments that will benefit both fish and waterfowl.

Habitat improvements for farmland wildlife such as rabbits, quail, and pheasants were carried out on private lands through cooperative agreements in 36 States. The trend toward quality rather than quantity continued. Manipulation of the habitat in forested areas increased deer browse and furnished herbaceous food in scattered patches, together with openings for grouse and turkeys. Activities included selective logging on private and public forests, reseeding browse and forage plants, fencing, and construction of access roads and trails.

Trapping and transplanting efforts were concentrated mostly on moving deer and wild turkeys into suitable but vacant ranges in the South. The State of Oregon secured 20 of the rare California bighorn sheep from British Columbia in an effort to restore this subspecies. Thousands of wildlife watering devices have been installed in the arid States and Hawaii to overcome local moisture deficiencies. Six of these installations in Nevada were found to be watering a population of 2,800 Gambel's quail where none had been present before.

During the year, 72,500 acres were purchased and 145,000 acres leased for wildlife purposes by 32 States. Primary emphasis was on

big-game ranges and management areas for forest and upland small game species. More than 8,800 acres were acquired in combination fish and wildlife projects.

Wildlife investigations were conducted in 45 States. Of those States, 38 emphasized collection of data on wildlife populations, production success, and harvest results to serve as the basis for annual hunting regulations. Waterfowl research stressed breeding-ground and winter populations surveys, migration studies, and hunter bag checks. Appraisals of the effectiveness of restoration activities for waterfowl and upland forms received attention in 40 States.

Revegetation of big-game winter ranges, particularly in the West, has posed many problems. Eight States engaged in studies to speed up the conservation of useless brushlands and overbrowsed ranges to productive range lands. Much progress has been made as a result of these studies. For example, bitterbrush, an important source of food for big game on western ranges, can now be reseeded successfully as a result of seed treatment that ensures early germination.

The publication of results is imperative if the interested public, administrators, and wildlife managers are to profit from project findings. During the year, 389 articles, bulletins, and books were published on the results of Pittman-Robertson activities.

Fish Restoration

Funds for the Dingell-Johnson program, from the excise tax on sport-fishing tackle, permitted the apportionment of \$4,532,800 to the States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands. Funds carried over from the preceding year enabled net obligations to reach \$4,692,000, an increase of 30 percent over last year. The number of projects undertaken by the States showed a pronounced rise, from 301 to 372. For the first time in program history, physical development and habitat improvement projects exceeded research activities in the amount of funds obligated. Scientific investigations continued to occupy a prominent spot in the program, however, with nearly \$2 million obligated for urgently needed fact-finding activities.

In fishery development, the creation of public fishing lakes continued to receive major attention. Construction was carried out on 28 areas where 3,250 acres of fishing waters will be impounded to expand presently inadequate fishing facilities. Elimination of undesirable fish populations by chemical treatment was conducted on 30 lakes by 13 States. Fishing of high quality will be assured following restocking in nearly 17,000 acres of lakes and 370 miles of stream. Access roads and other improvements to make waters available to fishermen were under construction in 16 States and Alaska.

Stream-improvement and watershed-development projects were financed in 7 States. The activities included erosion control, such as streambank protection, gully stabilization, fencing and tree planting, channel development, removal of log and rock barriers, and construction of fishways.

Twenty-one States purchased land for public fishing lakes and for access by anglers. Nearly 2,700 acres were acquired and an additional 56,000 acres have been leased for fisheries projects. More than 8,800 acres have been bought for combination fish and wildlife projects.

Perhaps the most notable trend of research activities in the fisheries field was the widespread interest in testing partial population poisoning to perfect and evaluate it as a fish-management tool. The method consists in water treatment with a toxic chemical in such a dilution that only undesirable fish, like shad and stunted panfish, are affected. Improved growth by more desirable species and increased angling success have followed most applications of this technique.

Surveys to produce information on fish numbers, species, and growth rates, and on water conditions in lakes and streams continue to occupy a prominent place in the program. Reservoirs also are under examination because of their importance as public fishing waters and because management techniques must be devised to ensure maximum production from these waters if they are to absorb their proper share of the Nation's sharply rising angling pressure.

A number of projects provided for detailed study of individual species of fish, mostly those that helped to give prominence to the fishing possibilities of an area but which subsequently declined in abundance. Creel censuses and fish population studies are under way, along with experiments in fish culture and stocking. Marine problems are the concern of a growing list of fishery projects on the Atlantic and Pacific coasts.

RIVER BASIN DEVELOPMENT AND WILDLIFE NEEDS

Of 265 reports this year by the Service on water developments planned by Federal agencies or by other interests under Federal permit, 102 were on Corps of Engineers projects, 55 on Bureau of Reclamation, 14 on Department of Agriculture, 52 on power projects requiring license from the Federal Power Commission, and 42 were special and miscellaneous studies.

Two important agreements were completed during the fiscal year. The first of these, with the Corps of Engineers, is designed to promote conservation of fish and wildlife resources in the development of flood-control, navigation, and multiple-purpose projects. The second, with the Soil Conservation Service, sets procedures for encourag-

ing the coordination of fish and wildlife conservation with soil and water conservation works carried out by local organizations with Federal assistance as provided by the Watershed Protection and Flood Prevention Act of August 4, 1954.

In September 1954 the International Association of Game, Fish, and Conservation Commissioners, representing the 48 State fish and game departments, adopted a resolution requesting the Fish and Wildlife Service to arrange for a nationwide economic survey of hunting and sport-fishing activities. The Service contracted with Crossley, S-D Surveys, Inc., for a survey of hunting and fishing expenditures by sportsmen during 1955. This will be the first nationwide survey of this nature. The results will be published after completion of the survey in June 1956.

In line with the Coordination Act of 1946, plans were completed this year for the use of six reservoir areas for wildlife management. Lands have been made available to the State conservation departments at Garrison Reservoir and Lake Ashtabula in North Dakota, Willow Creek Reservoir in Colorado, Conemaugh Reservoir in Pennsylvania, Angostura Reservoir in South Dakota, and Cedar Bluff Reservoir in Kansas. In addition, a Federal refuge has been established at Kirwin Reservoir in Kansas, and one is planned for part of the Snake Creek arm of Garrison Reservoir. At Garrison, after extensive negotiations, the Corps of Engineers initiated development of wildlife habitat to compensate for part of that flooded by the reservoir.

The inventory of wetlands completed last year has been enhanced by a followup inventory of permanent water areas. Together, these surveys provide the most comprehensive summarization ever compiled of habitat available to waterfowl and other wetlands wildlife. Individual State reports are available for limited distribution, and a national summary is being prepared for publication. These data provide the background for a nationwide wetlands habitat preservation program now under way. The program has been designed to discover conflicting interests in wetlands use and to determine how these may be reconciled and how the impact of land-use changes detrimental to wildlife may be reduced.

Other important actions relating to water developments include the start of construction by the Bureau of Reclamation of a fish hatchery at Nimbus Dam in California to compensate for the loss of salmon spawning beds, and passage of a law expanding purposes of the Central Valley project in California, to include use of project waters for fish and wildlife purposes. The joint Federal-State surveys of the Arkansas-White-Red Basins and the New England-New York area were completed, and special studies were begun on the relation of fish and wildlife to specific major power projects in Oregon, Wash-

ington, and Idaho. Other studies were pursued on fish and wildlife resources in certain Alaskan watersheds and in the Rogue River Basin of Oregon, and on the impact of dams on the striped-bass fishery of the Roanoke River in North Carolina. In connection with the proposed Garrison irrigation project in North Dakota, particular attention has been given to the protection of existing national wildlife refuges and to potential fish and wildlife developments.

CONTROLLING DAMAGE BY ANIMALS

The fiscal year 1955 was the 40th of Federal participation in organized predator and rodent control in cooperation with State, county, municipal, and other organizations. As in the past, farmers, ranchers, sportsmen, and other groups were benefited by techniques evolved over the years. Control is necessary not only to prevent losses to livestock and crops, but also to suppress outbreaks of rabies and other diseases spread by wild animals.

Major effort was devoted to the continuation of long-established projects for the protection of livestock, poultry, and game from predatory animals, particularly coyotes and bobcats. While many instances of predation upon sheep, goats, calves, and domestic fowl occurred during the year, prompt action prevented these losses from reaching serious proportions. For example, although heavy storms in the Sierra Nevadas of California in January 1955 caused a downward drift of coyotes into the San Joaquin Valley, hunters stationed in the area were able to catch most of the animals, and losses to wintering bands of sheep and to 2½ million turkeys, raised on valley ranches, were less than during the previous year.

In several of the Western States, control work was handicapped by drought, fluctuations in livestock numbers, and reduction in cooperative funds for the employment of field personnel. In Utah, particularly, the hunter force was inadequate to prevent a buildup of coyote populations. Experience indicates that such conditions are costly, since losses through increased predation are much greater than the temporary savings from reduced expenditures. Predator control in Alaska was carried out on a reduced scale during the year. Satisfactory increases in the once depleted Nelchina and Peninsula caribou herds were attributed largely to earlier wolf-control measures by the Service. Emphasis was shifted to protection of caribou and reindeer in the Arctic range and other big-game species in southeastern Alaska. The latter activity was partially financed by the Territorial government.

Field employees assisted the public in the control of various species of rodents and other small mammals. Native mammals that fed upon

agricultural crops in various sections of the country included jack rabbits in Idaho wheatfields, pocket gophers along Arizona irrigation canals, cotton rats in South Carolina watermelon fields, moles in urban lawns, white-footed mice in west-coast reforestation projects, and tree-girdling mice in New England orchards. Rising costs of labor and materials intensified the need for more efficient procedures. This problem was partially solved for fruit growers by perfection of a mechanical device for poisoning mice in apple orchards.

Little change occurred in the high postwar level of rabies outbreaks among wild animals. Whereas the trend was downward for dogs, cases reported for wildlife increased from 311 in 1944 to 1,694 in 1954. Countywide projects to control rabid foxes were carried out in parts of Virginia and North Carolina after 7 persons were bitten and 37 rabid foxes were killed over a 2-month period. Similar outbreaks, with resultant losses to livestock, took place in many States, particularly in the Southeast and in California. During the past 2 years, 6 kinds of bats have been found to be carriers of rabies. The role these bats play in spreading the disease to other animals is as yet unknown.

It is recognized that, owing to control measures, the extent of damage encountered in many other parts of the world no longer occurs in this country. For example, recent famine conditions in several Philippine provinces were largely the result of 90-percent loss of rice crops to rats. Several countries plagued by such wildlife-damage problems requested help during the year. Canada, Mexico, the Union of South Africa, the Philippine Islands, and Caribbean areas were assisted in combating losses caused by animals, ranging from wolves in the Arctic to rats and mice in the Tropics.

American food industries were confronted with domestic rodent problems aggravated by surpluses of wheat, corn, and other cereal grains.

At many storage sites rats and mice increased in numbers, consumed or contaminated much of the product, and infested surrounding communities. Service personnel assisted the dried-fruit and grain-handling industries in combating such situations. They participated in numerous meetings and community rat and mouse control projects as part of a current nationwide grain-sanitation program sponsored jointly by industry and government. The first two developed anticoagulant rodenticides, warfarin and pival, were widely used in control operations, and there was reduced demand for the more hazardous, highly toxic chemicals. As a result of this trend, the manufacture of Compound 1080 was discontinued. Extensive field tests with a new anticoagulant rodenticide, fumarin, were made in Texas, Louisiana, and Mississippi.

Cooperative predator and rodent control operations during the year entailed expenditures of \$935,924 from regular departmental appropriations, supplemented by \$1,321,572 from cooperating States and \$2,952,978 from cooperating counties, livestock associations, and others. The recorded catch of predatory animals by Service and cooperative personnel was 55,204 coyotes, 2,658 wolves, 19,249 bobcats and lynxes, 874 stock-killing bears, and 195 mountain lions. In rodent control operations, 10,554,715 acres of land were treated for elimination of prairie dogs, ground squirrels, pocket gophers, jackrabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addition, 418,671 premises were treated in cooperative campaigns for the control of rats. Special equipment and supplies used in both predator and rodent control, and 337,193 pounds of rodent-bait materials, were distributed by the Service's supply depot at Pocatello, Idaho.

INTERNATIONAL COOPERATION IN CONSERVATION

International Technical Cooperation

The Fish and Wildlife Service continued to cooperate closely with the Foreign Operations Administration in technical assistance to friendly nations. Fishery development projects were carried on in Mexico, El Salvador, Peru, Ecuador, Bolivia, Liberia, Iran, Pakistan, India, and Indonesia. On January 15, 1955, employees of the Service assigned abroad under this program were transferred, with minor exceptions, to the Foreign Operations Administration. The Service assists the Administration by providing technical information, recruiting competent technicians, and supervising the instruction of foreign students in the United States.

In India, mechanization of small boats has increased production by cutting down the running time to and from the fishing grounds. Special motor and railroad vehicles permit the rapid transport of fresh fish to inland areas. In addition to the usual fishing near shore, purse seining in more distant waters has been done experimentally. This kind of program in India should help to increase the present low per capita consumption of 4 pounds per annum, compared with 16 pounds in Ceylon, and 70 pounds in Burma.

The fishery terminal planned for Karachi, Pakistan, has been approved, and construction will begin soon. A dual-purpose vessel is being put into service to do exploratory fishing with trawls and purse seines. In Indonesia, the effectiveness of longline fishing for tuna has been demonstrated, and a start has been made in exploring for large shrimp resources. The number and extent of the islands of this archi-

pelago present a great problem and a greater opportunity for fishery development. In Latin America, projects continue in Peru and El Salvador, but the one in Mexico was terminated at the end of the fiscal year.

In many parts of the world there is opportunity of developing inland waters, to make fresh fish available near the points of principal need. A program of development recently begun in Liberia has attracted great interest among farmers, and it is expected that the number of ponds will be multiplied many times in the next few years.

The training of foreign students in the United States continues to be an important part of the technical assistance program. This year, 26 students from 12 countries received training in 7 branches of fishery science and technology. Four students came from Latin America, 4 from the Middle East and Africa, and the rest from countries of Southeast Asia, principally Indonesia and Thailand. From time to time, reports are received on the activities of trainees who have returned to their home countries to put into practice the newly acquired knowledge and skill. To ensure lasting benefits, these technicians must assume responsibility for the continuation of projects initiated by American experts.

International Conservation Agreements

During the fiscal year 1955, the Service was concerned with the activities of several international fishery conservation organizations, as well as two major international conferences.

As a result of a new International Pacific Halibut Convention and subsequent changes in the management of the halibut fishery, the catch in the summer of 1954 broke all records, producing approximately 71 million pounds of fish, a gain of 11 million pounds or 18 percent over the preceding year's catch.

The International Pacific Salmon Fisheries Commission also produced striking results. The 1954 catch from the sockeye salmon runs of the Fraser River system exceeded by far any runs since the organization of the Commission.

The International North Pacific Fisheries Commission held its first annual meeting in Vancouver, British Columbia, in October 1954, and adopted a research program. This program has been accepted in substance and is being implemented by the three Governments—Japan, Canada, and the United States.

The International Commission for the Northwest Atlantic Fisheries held its fifth annual meeting in Ottawa in June 1955. Possibly the most important of its actions was a recommendation, to the member governments, of regulations limiting the size of meshes to be used

in the trawl fisheries for haddock and cod on the Nova Scotia and Newfoundland Banks. A similar regulation for Georges Bank and the Gulf of Maine has been in effect approximately 2 years and has benefited American fishermen at the rate of about a million dollars a year.

The International Whaling Commission held its regular annual meeting in Tokyo in July 1954, when it reviewed statistics on the catch of the previous season and adopted a number of significant changes in its regulations.

The Inter-American Tropical Tuna Commission, composed of representatives from the United States, Costa Rica, and Panama, continued its research on the tunas of the eastern tropical Pacific Ocean. This research has not yet reached the stage where it is possible to speak definitively, but there are indications that some of the tuna stocks are being exploited at a rate above that which will permit maximum sustained yield.

The Indo-Pacific Council held no meeting during fiscal year 1955. Its sixth annual meeting will be held in Tokyo in September 1955, when work of the past 18 months will be reviewed and plans laid for future work.

Officers of the Service were members of the United States delegation to the United Nations International Technical Conference on Conservation of the Living Resources of the Sea, in Rome in April 1955. This conference, possibly the first of its kind, brought fishery experts from some 50 nations in an attempt to find ways to cooperate in ensuring maximum production from important marine resources. The report of this conference was submitted to the International Law Commission of the United Nations, which met in Geneva in May and June 1955.

Officers of the Service were also members of a United States delegation which, with representatives of Canada, signed a Convention for the Great Lakes Fisheries on September 10, 1954. The Convention was ratified on June 6, 1955. Under its terms a Commission will be established to bring under control the parasitic sea lamprey which has damaged the Great Lakes fisheries in recent years, and to promote and coordinate investigation of those fisheries.

THE NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*



THE past year has been marked by numerous events and developments of such interest and importance as to make it one of the truly noteworthy years in the history of the National Park Service.

Two major events are closely related to each other. The 1955 appropriation provided for the first real increase in seasonal personnel in many years; it made funds available for a long start on an overdue road-and-trail construction program; and, by matching a \$500,000 donation for land acquisition, and at the same time continuing the established \$250,000-a-year land purchase item, it made a total of \$1,250,000 available to speed up the Service's land program.

These increases are gratifying, but they do not solve the problems of the National Park System, nor will they if continued at their present rate. The System is truly a national asset of major importance socially and economically; it is one of the most important "identification marks" of a free people. The fact that, for one reason or another that may have seemed justified at the time, the System has been allowed to deteriorate because of necessarily lowered standards of maintenance, protection, and development has caused serious national concern. This, coupled with our efforts to obtain increased appropriations, on a yearly basis, to correct the situation, has convinced us that we must approach the problem differently; that we must prepare and submit a sound, long-range, economical, one-package program to meet future needs as well as to cure current bad conditions.

This has led to the undertaking to which the name Mission 66 has been attached. This is an all-out attempt to evaluate every practice of the Service and all of its administrative and development planning; its purpose is to formulate a program which, if followed, will see the National Park System adequately developed and adequately staffed by 1966—the 50th anniversary year of the establishment of the Service.

Defense against unsuitable developments.—Deeply gratifying to the Service has been the intense interest in MISSION 66 shown by Secretary McKay, Assistant Secretary Lewis and others in the Department. Equally gratifying have been the evidences of the Department's determination to protect the character of the areas of the National Park System. Secretary McKay's decision against the proposal for construction of a tramway up the side of Mount Rainier and down to Crater Lake; departmental approval of the Director's refusal to permit construction of a television tower atop Scotts Bluff; and the Secretary's opposition to the Glacier View Dam project, in Glacier National Park, and to proposals to reduce the size of Olympic National Park—all these exemplify his and the Department's attitude.

New region approved.—With the establishment of an additional region, Region Five, scheduled for July 1, 1955, the reorganization of the Service, begun nearly 2 years ago, has reached virtual completion. Congressional doubts as to the necessity of adding a region and even of continuing Region One were dispelled by a careful restudy of the Service's existing regional setup by a special departmental committee. The Appropriations Committees of both House and Senate readily agreed to the budget request for funds with which to operate a Region Five office in Philadelphia. The reorganization is showing excellent results.

Concessions.—The year was also notable with respect to certain park concessions developments. One of these was the purchase by Fred Harvey of all Santa Fe Railroad interests in the services provided visitors in Grand Canyon National Park, to be followed by modernization and expansion of South Rim facilities, where they are much needed. Another was the completion of Jackson Lake Lodge at Grand Teton National Park, constructed with funds supplied by Jackson Hole Preserve, Inc., a nonprofit distributing corporation established by John D. Rockefeller, Jr. A third was the decision against providing lodgings of any kind at Flamingo, in Everglades National Park, and to count upon private enterprise to furnish these outside the park, as has been done at Great Smoky Mountains National Park.

Study of interpretation.—For more than 30 years, the interpretation phase of the National Park Service's work has steadily gained in extent, effectiveness, and public acceptance. Since the establishment of a Division of Interpretation, as part of the Service's reorganization, there has been intensified effort to increase the effectiveness of the interpretive program. In the belief that it would tend to strengthen and give better direction to this program, a 2-year study and appraisal of interpretive activities carried on by the Service and by other public and private agencies is being undertaken by Freeman Tilden, who is especially well qualified for such a study. It is being financed by an anonymous donation.

Operations Division.—Organization of the Division of Operations was completed with the establishment of a Branch of Conservation and Protection, headed by a chief with long and varied field and Washington office experience. This branch, which embraces sections on forestry and on maintenance, gives all matters related to park protection definite representation in the Washington office for the first time.

Rockefeller benefactions.—The donation of \$500,000 for land acquisition, to match the same amount of appropriated funds, was made by Jackson Hole Preserve, Inc., the nonprofit corporation established some years ago by John D. Rockefeller, Jr., to finance various undertakings in park conservation. The corporation also financed the construction of the new Jackson Lake Lodge, in Grand Teton National Park, and the purchase of lands for a prospective Virgin Islands National Park on the island of St. John. Direction of the corporation's affairs lies largely in the hands of Laurance Rockefeller, who shares his father's deep interest in the national parks.

Publicity.—The growing and more intelligent interest in the national parks and their welfare has been indicated during the past year by an exceptionally large number of magazine and newspaper articles and editorials. These, as a rule, have called public attention to the vastly increased visitor load on the National Park System, and to the handicap of inadequate development and insufficient staffing, and they have urged increased appropriations to meet the Service's needs.

Coastal studies.—Financed by anonymously donated funds, the Service was nearing completion of a 2-year study of the Atlantic and Gulf coasts, undertaken to discover the most distinguished areas along these coasts which remain in relatively unspoiled condition. The findings of this study should be of interest and concern to the Federal Government and to the various State and local governments, since beaches and related coastal areas possess high value for active recreation as well as unique scenic, scientific and historical values; considerable enlargement of public holdings of such property is greatly needed. Donated funds are also making possible the thorough study, launched during the year, of the geology and history of the Cape Hatteras National Seashore.

Personnel.—Printed and spoken tributes to the high quality of the men and women employed by the Service continue to be numerous. Aware of their devotion, and the exacting demands made upon them by the requirements of their work, the Service has labored with marked success to upgrade those whose responsibilities warranted it. The positions of 115 superintendents and those of a number of other employees have been advanced in grade during the past year. This long overdue improvement has been a great help to the morale of the Service.

Assembly Room at Independence Hall refinished and refurnished.—When the General Federation of Women's Clubs held its convention in Philadelphia in May, the Service was proud to display the refinished and refurnished Assembly Room of Independence Hall to its president and many of its members, as a finished part of the project which is to be extended to the entire first floor of the structure. This work is being financed by a gift of about \$210,000 raised by the federation and presented to the National Park Service. At ceremonies preceding the convention a Donors' Book was presented to the Director who, in turn, presented a special citation to the federation for its splendid accomplishment.

Benefactions.—The National Park Service has reason to feel deep gratitude over the extent to which it has benefited during the past few years from the foresighted generosity of individual, corporate, and foundation donors to various phases of its work. The year 1955 has been especially notable in this respect, as may readily be gathered from the preceding paragraphs and elsewhere in this report. The many contributions bear witness to the wisdom of the Congress in having authorized the Donation Fund in 1920 and the National Park Trust Fund in 1935.

A limited distribution of "The Fifth Essence," which describes the work and some of the problems of the Service and indicates some of the fields of activity which would benefit from benefactions, has produced much favorable reaction which it is hoped may result ultimately in enlargement of the National Park Trust Fund. This year there was wider distribution of the book to foundations, to trust officers of banks, and to numerous persons of means. A member of the Director's staff has been given the responsibility of following up on "leads" and devising means of interesting possible donors in contributing to the fund.

MISSION 66

For some years it has been apparent that use of the National Park System has outrun its capacity, as presently planned and developed, to meet the demands on it. Travel has increased to the point of embarrassment, while provision for it and for better protection of both the parks and those who use them has been deferred again and again because of lack of funds. Since 1941, appropriations for management, for protection, and for development have lagged seriously behind the need for them occasioned by greatly increased public use. The System, designed for 25 million visitors a year, is now called on to bear a load that is twice that heavy. One result has been a flood of publicity, most of its sympathetic, some of it frankly critical, calling attention to the dilemma of the National Park System.

The only solution is to formulate and carry out a sound, overall program of improvements. Piecemeal efforts are not enough. At the same time, the attention given to these problems by this publicity encourages confidence that such a program will receive public acceptance.

Planning for today and the immediate future, and construction on that basis, can lead only to future embarrassment and to renewed demands for more of everything. We must "back off" and take an objective look at the National Park Service and what it is doing; appraise the effectiveness of its policies of protection and use; and determine what, and where, additional development is actually needed, in the long view. Above all, we must scrutinize the way things are done, having in mind the most efficient use of limited manpower and funds.

Such a comprehensive study of every phase of the National Park Service's responsibilities has been launched, under the designation of MISSION 66. Its objective is to prepare today a program that will fit park operation and development to the needs of 1966 and that will permit such further development as the years thereafter may require without the necessity of radical changes. This is a doubly fitting goal; a 10-year forecast is about as far as a reliable plan can be projected, and 1966 is the 50th anniversary year of the establishment of the National Park Service. It is our goal that by 1966 the plans being made now will have been carried out, and travel, development for visitor needs, and park protection brought into proper harmony.

To achieve this goal, the MISSION 66 steering committee and its staff began with a review of past plans, files, and records to permit consideration of all previous proposals for changes in development plans and operation methods.

While these materials were being examined, all employees in the field and at various headquarters offices were encouraged to envision an ideal situation for those areas with which they were intimately acquainted, and to put their ideas in writing. Many suggestions of great value to improve park protection, park use, and park management have resulted.

It is assumed that provision must be made for a 60 percent increase in visits over 1955, for a total of 80 million. On this basis, we are developing plans to insure continuing protection of the important features of each area, and to provide facilities required by visitors, as well as a full staff for management, protection, and maintenance.

For guidance in developing the MISSION 66 program, all policies and procedures have been carefully examined. Wherever necessary, they are being restated to fit a modern world in which increased leisure is expressed in greater automobile and air travel, and in

new ways of handling various problems of operation. These revised "precepts," calling attention to important park problems, place protection in first priority, but indicate that proper development is the key to good protection, and that visitor use is the best possible protection against encroachment.

The location of administration offices, warehouses, shops, and residences was studied, and it was decided that they should be separate from areas used intensively by visitors. Many parks and, in some instances, important portions of parks can best provide visitor appreciation through day use, rather than overnight use. Traffic problems require solution by modern methods; for example, some alternative must be provided for the huge open parking spaces now required. These suggest the kinds of problems being faced, and some of the possible methods of solution.

In some situations, without question, Federal and State properties adjoining the parks will be called upon to provide some of the space and some of the services required to meet the needs of park visitors. Expansion of the recreational facilities of the national forests and of State parks and forests will help materially in supplying expanding public recreation requirements. We expect to expand our cooperation with the proper sister agencies to this end.

Committees in the field areas and in the Regional and Design and Construction offices are also working on the program. It is, in fact, a servicewide effort, with boldness in thinking the key to the endeavor. The final report on MISSION 66 will present the problems, and the solutions recommended for them; it will require legislation and this will be ready for the consideration of the second session of the 84th Congress. It is the dream of park administrators that, with the support of the Department, MISSION 66 will result in getting done what needs to be done if the parks are to fill their highest purpose in the modern American way of living.

INFORMATION AND INTERPRETATION

The National Park Service's interpretive and informational activities reach millions of persons who make use of the areas administered by the Service and who share in the ownership of this priceless part of our national heritage. These persons are seeking a clearer and deeper understanding of the natural and human history of their country and of the interrelationships of man and his surroundings exemplified in the National Park System, and an informed appreciation of what we, as Americans, possess and that strong pride in it which we call patriotism.

This part of the Service's work presents a constant challenge to make every phase of it more useful to our visitors; to seek out and use every improved technique that our means permit; to find men and women best qualified to engage in it; and to provide them adequate, stimulating training.

Reorganization completed.—Reorganization of the Division of Interpretation was completed with the filling of the four regional chief of interpretation positions and through adjustments within the branches in the Washington office. Establishment of a Photographic Section in the Branch of Information, to program and coordinate servicewide photographic activities, was a major change; the branch's Public Information Section was also reorganized and strengthened.

Visitor services grow.—A definite index of the extent of the Service's interpretive activities is found in the figures showing the number of persons served by three major phases of the program. A total of 2,138,592 visitors participated in guided trips; audiences at talks, lectures, campfire and similar programs totaled 3,969,084; while 13,724,301 persons made use of such interpretive facilities as museums, historic houses, and other attended exhibits.

Written and telephoned requests to the Washington office alone for publications during the second half of the fiscal year increased about 45 percent over the corresponding period of 1954, yet were met with reasonable promptness without increase of staff. A new Eastern United States map, showing Service-administered areas and containing essential information about each (a companion of the Western United States map produced last year), made it possible to meet most of these requests much more economically from the standpoint of number of publications required, postage costs, and speed of processing.

Regional training conferences for both protection and interpretive personnel were held at St. Augustine, Fla., and Rapid City, S. Dak., last spring and were an important step toward more effective visitor services. Issuance of the revised Manual of Information and Interpretation in the Field and of three new training-aid booklets—Guided Trips, Campfire Programs, and Information Please—contributed materially to better results in both informational and interpretive work.

Publication production at high level.—The Editorial Section of the Branch of Information was without the services of a chief during 9 months of the year; nevertheless the program was carried through successfully and efficiently. In addition to the production of so-called free publications, the year brought notable additions to the Service's sales list. New historical handbooks produced included those for Fort Laramie National Monument and Vicksburg National Military Park;

manuscripts for Bandelier and Ocmulgee National Monuments and Kings Mountain National Military Park went to the printer. In addition, pending the production of handbooks for Appomattox National Historical Park and Fredericksburg and Spotsylvania County National Military Park, the 16-page booklets for these areas were revised and reissued. The archeological research series was enlarged by the appearance of No. 2, *Archeological Excavations in Mesa Verde National Park, Colo.*, 1950.

Natural history handbooks for Badlands National Monument and Rocky Mountain National Park, Nos. 2 and 3 in this series, were also produced during the year. Revision of the long popular tree preservation series advanced with the production of No. 1, *Transplanting Trees and Other Woody Plants*, and the submission to the printer of No. 4, *Shade Tree Pruning*, and No. 7, *Rope, Knots, and Climbing*. This series, produced primarily for guidance in the care of the many shade trees growing on historical areas administered by the Service, has been in steady demand since issuance of the original edition in the late thirties.

Starting with the Sequoia and Kings Canyon National Parks booklet, revision of all national parks information publications is planned, to be accomplished in 4 years. This involves rearrangement of material, adoption of a more friendly, person-to-person tone in the writing, and adoption of a new and handier format. To as great a degree as possible, other publications have been given such rearrangement and modification of tone, without major revision.

For the maps which are to be included in the revised national parks publications, the Service is availing itself of the expert cartographic services of the Geological Survey.

During the year, 110 requisitions were issued for the printing of 7,462,000 copies of informational publications, each dealing with a single area, 6 for revised or new sales publications, and 19 for plate changes in sales publications, and for other miscellaneous publications, such as the constantly useful leaflet, *National Parks and National Forests*.

In addition to their services in providing books, equipment and other materials to strengthen the interpretive programs of those areas in which they operate, natural history associations and other cooperating societies continue to supplement the Service's publications program. Several distinguished new publications issued by the societies reflect the Service's effort to assist them in improving these in both content and appearance.

New aids to visitors developed.—The employment of a field naturalist with responsibilities in Regions Two, Three, and Four has greatly accelerated the efforts to integrate new interpretive facilities

with current construction programs. This applies, thus far, particularly to construction at Mount Rainier, Olympic, Grand Teton, and Grand Canyon National Parks and at Wupatki and Sunset Crater National Monuments.

There was a healthy growth in the number of self-guiding trail and tour facilities, with approximately 50 devices of this type being installed. The study of self-guiding trails and tours begun last year has continued through 1955 and the second part of this study was released to the field areas for their guidance.

The Audio-Visual Committee, representing the Divisions of Interpretation and Design and Construction, tested the efficiency and effectiveness of commercially available recorders, slide projectors, and record players. Results of this research, furnished to the field, will result in considerable saving of time and money by making similar analysis by individual areas unnecessary. Near the end of the year, funds were made available for the experimental installation of three types of audio-visual equipment—electronic guiding systems, high-fidelity public address systems, and automatic illustrated program devices.

The care of exhibits.—Museum work during the year included the care of growing collections of important historic and scientific objects and the building of exhibits to help interpret the parks. Donations of exhibit materials, many of which are of great value, impose on the Service a special obligation to provide them the most complete and expert care its means will permit.

Among the objects entrusted to it for museum use was the garrison flag which flew over Fort Sumter at the outbreak of the Civil War and the storm flag, also in the fort at the time. An antique brocaded stole from the vestments of a missionary priest, perhaps as early as Father Kino himself, was given to Tumacacori National Monument. Another missionary relic with rich associations—the French-English dictionary presented to Elkanah Walker by Captain Sutter at the Whitman Mission—was given to Whitman National Monument. Exceptionally fine examples of armor, swords, pole arms, and other military equipment of the 16th and early 17th centuries were obtained with the help of generous citizens for museums at Jamestown Island, Fort Caroline, and San Juan. Acquisition of Washington's campaign tent is recorded elsewhere.

To preserve and restore the murals in the rotunda of the Old Courthouse at Jefferson National Expansion Memorial in St. Louis, a crew of art students was trained to help the staff specialist in the tedious and intricate task of reattaching loose paint, cleaning the surface, and repairing losses. Museum Laboratory specialists gave preservative treatment to collections at Chickamauga and Chattanooga National

Military Park, George Washington Birthplace, Hopewell Village, Independence National Historical Park, and Vanderbilt Mansion. Specimens from several other areas were treated at the Museum Laboratory. The branch preservation laboratory at Jamestown was fully occupied most of the year in cleaning and treating the thousands of objects being excavated there. The branch laboratory at Gila Pueblo made good progress in the safe storage and cataloging of archeological collections from Southwestern areas.

Service policy governing museum collections was carefully reviewed and a revised statement was submitted to the Advisory Board for study.

In cooperation with the American glassmaking industry, the Service, having in mind the Jamestown 350th Anniversary Celebration in 1957, began the development of Glasshouse Point. In close association with the remains of the Jamestown glassworks of 1608-24, cooperating glass companies will build and operate, as an educational exhibit, glassmaking facilities similar to those of 1608, first factory industry in English America. For the general interpretation of the Jamestown-Yorktown story, the Service made substantial progress on museum prospectuses for the visitor centers and museums at Yorktown and Jamestown, now under construction at a cost of \$300,000 each.

New museums and exhibits.—New museums were opened on the Blue Ridge Parkway and at Joshua Tree National Monument. On the parkway, where the road skirts an important mining district, the State of North Carolina appropriated funds to build and install a museum of North Carolina minerals. The Service designed the building and planned and constructed the exhibits, which tell the story of how the minerals are mined, processed, and used.

A new set of exhibits was prepared for the Mountain Pioneer Museum at Great Smoky Mountains National Park to correlate with the nearby Pioneer Farmstead. Average attendance at this museum has been more than 1,500 a day during the current season.

At the Jefferson National Expansion Memorial, an extensive exhibit of ironwork was installed, mostly of architectural cast iron saved from the riverfront memorial area. Other series of exhibits were designed and installed in the lobby of the new administration building at Saguaro National Monument, the information center at San Juan National Historic Site, and the temporary headquarters at Harpers Ferry National Monument. The Museum Laboratory constructed individual exhibits for 15 parks.

A special set of displays was designed and constructed for the experimental information station installed just inside the West Yellowstone entrance of Yellowstone National Park. These tell visitors what they need to know about roads, distances, accommodations and services, and what to see and do in the park.

Wildlife.—The nationwide reduction of carnivorous animal population has resulted in certain wildlife imbalances, including excessive numbers of ungulates and rodents, in several areas. The excess of elk, beyond the capacity of available winter range, at Yellowstone has presented a serious problem, not yet solved, for a number of years. Last winter, 593 were trapped and shipped elsewhere while hunters outside the park killed 763. The combined total falls several hundred head short of the normal natural increase. At Yellowstone also 288 bison were removed; 226 of these came from Hayden Valley.

At Wind Cave National Park, with assistance from Custer State Park, 300 elk and 146 bison were removed; at Rocky Mountain National Park, 53 elk and 24 deer; at Platt National Park, 4 bison; at Sequoia National Park, 125 deer. At Grand Teton, 103 elk were shot by the 600 permittees deputized as park rangers pursuant to Public Law No. 787.

It is encouraging to note that, under effective Service protection, certain wildlife species threatened with local and, in some instances, nationwide extinction have increased in numbers. Important among these are the trumpeter swans in Yellowstone and Grand Teton National Parks, the Dall sheep at Mount McKinley, the desert bighorns at Mesa Verde, and the roseate spoonbills, manatees, white-tailed deer and alligators at Everglades. The Service is hopeful that the decline in prairie dog populations in some western parks and monuments can be arrested. Visitors find these small animals of exceptional interest.

Research.—Careful research is a necessity of both sound interpretation and proper management. The National Park Service, of necessity, must conduct a considerable amount of it in the fields of history, archeology, and natural history in order to give increasing effectiveness to its interpretive program.

The 2-year study of interpretive methods, mentioned elsewhere, gives promise of producing recommendations that will further streamline and strengthen interpretive activities. During the past year, additional visitor-use studies have been completed at Kennesaw Mountain, Acadia, Death Valley and Fort Sumter; others at Scotts Bluff and Effigy Mounds are in progress. Such studies are important for improvement of interpretive and informational facilities and for planning and management of the areas.

Numerous research projects dealing with natural history or its interpretation are completed or in progress. These include the Katmai National Monument inventory; fisheries investigations; Yosemite, Acadia and Death Valley visitor-use studies; studies of visitor impact on giant sequoias and of rabbit devastation on Santa Barbara Island; an ecological study of Big Bend; animal population and browse studies at Grand Canyon, Yellowstone, Mesa Verde, Wind Cave, Sequoia,

Olympic, Isle Royale, Theodore Roosevelt and Colonial; and geological field work at Big Bend and Joshua Tree.

Some of this work is performed by Service personnel, some by or with other Federal agencies, and many through cooperative agreements with universities, State agencies, or individual research scientists affiliated with reputable organizations.

The reactivated archeological program at the site of the first permanent English settlement at Jamestown, Va., resulted in numerous important discoveries, such as the foundations of a street of row houses, a sturdy foundation as yet unidentified but possibly that of the second Statehouse of the Virginia Colony (1656-60); and the breastplate and backplate of a suit of armor and a sword of the period 1595-1610 with the name of the maker still readable on the blade. Numerous sword hilts and pieces of matchlock muskets (earliest firearms used at Jamestown) were found in association with each other at what appears to have been the Jamestown armorer's shop of 1611-25.

On the grounds of the Association for the Preservation of Virginia Antiquities, a Service archeologist excavating in and near the foundation of the third (1665-76) and fourth (1686-98) statehouses discovered 70 burials in a cemetery so old it had been forgotten by 1650. Believed to be a cemetery of the "starving time," 1609-10, a movement is on foot to honor these victims of the most trying period in the founding of Virginia. Another archeological project exposed the foundations of Royal Governor Sir William Berkeley's mansion at Green Spring, the first great English house in America.

Through cooperative agreements, archeological excavation projects were carried out by four local institutions at two reservoir sites. North Dakota State Historical Society and the University of South Dakota worked in the Oahe Reservoir area; the University of Kansas and the Nebraska State Historical Society investigated sites in the Fort Randall Reservoir area. With funds provided by this Service for the purpose, the Smithsonian Institution also carried out important archeological salvage investigations in the Fort Randall and Oahe Reservoir areas.

John White paintings of 1585-86, to be published.—Donated funds have enabled the Service to assist the University of North Carolina Press in publishing facsimile reproductions in color of the famous watercolor drawings made by John White in the Cape Hatteras area in 1585-86. Accurate reproductions of these drawings, now in the British Museum, have long been desired by American scholars.

George Washington's Revolutionary war tent purchased.—A generous but anonymous donor made possible the purchase of the tent used by George Washington all through the Revolutionary War. Used by Washington for purposes of sleeping and as a place for writing im-

portant dispatches during his campaigns, the tent has outstanding national interest for the American people. Inherited by George Washington Parke Custis, of Arlington, foster son of George Washington, the tent passed from him to his only daughter, the wife of Gen. Robert E. Lee, and was sold to the National Park Service by the Lee heirs. It will be preserved and exhibited at Yorktown, last battlefield on which Washington used it. The cover or some other memento will be placed at the Custis-Lee Mansion at Arlington.

John Marshall Bicentennial and Woodrow Wilson Centennial Commissions.—During 1955 the Director served as executive officer of the John Marshall Bicentennial Commission, established to celebrate the 200th anniversary of the birth of our greatest Chief Justice, and of the Woodrow Wilson Centennial Commission, created to commemorate the 100th anniversary of the birth of President Wilson.

Assistance to writers.—Heightened public interest in the national parks and in the needs of the National Park System has both been caused by and resulted in an unusual number of magazine and newspaper articles and editorials dealing with the System. This has meant an increased demand on the Service for data, which has been supplied as accurately and factually as possible. This evidence of interest, and of the esteem in which the Service seems generally to be held, has been heartening, as has been the unusual series of advertisements dealing with the national parks, and the conservation organizations which have worked effectively in their behalf, launched during the year by the Sinclair Oil Corporation.

Cooperative assistance.—The Service continued to work with the Department of State in connection with the International Convention for the Protection of Cultural Property in the Event of Armed Conflict, which must be ratified by the United States Senate. Professional advice in the identification or preservation of historical and military objects or other aid in the field of military history was extended to 18 different agencies of the Federal Government, 15 State agencies, and 11 private or semipublic organizations. A large piece of Spanish armor (a brigandine) of the period 1530 found near Tampa, Fla., and doubtless a relic of the De Soto Expedition, first major exploration of the North American interior (1539-43), was identified and treated.

OPERATIONS

The Operations Division, with the impetus given it by the Department's reorganization decision, has fitted well into its intended function on matters concerned with park operation, maintenance, and protection, and with control of programs for park betterment. Emphasis in both Washington and Regional office operations has been on

assisting park organizations to care for the areas and to manage the use of them for the ever-growing multitudes of park visitors. Seasons of use become longer, numbers of visitors are constantly greater, and needs increase in proportion.

The Branch of Conservation and Protection has completely functioned for the first time this past year under a branch chief of wide experience selected from the ranks of park superintendents. Programming procedures have been devised and placed in operation to insure coordination of planning, financing, and expenditure for all park improvements. The needs of field areas remain in first priority in line with new concepts of management.

Travel to the parks.—Public use of the areas continued the upward trend that has been constant since 1946. Visits to all areas administered numbered some 47,800,000 in 1954 as compared to 46,200,000 in 1953. Thirteen areas attracted more than 1,000,000 each. Of these Blue Ridge Parkway recorded some 4,300,000; two other areas had more than 2,000,000 each.

Travel survey.—Further progress was made toward completion of travel surveys of certain national parks which started several years ago. These were undertaken to obtain much needed information on the travel habits and expenditures of park visitors. They are conducted in cooperation with the Bureau of Public Roads and the several State highway departments concerned. During the year both the Yosemite and Shenandoah National Parks travel surveys were published. A report on the Grand Canyon National Park survey has been prepared and is being published. Plans are being worked out with a nationally known survey organization to make an overall study of park travel trends, especially park visitor requirements and the different kinds of overnight facilities they would like to have. This will have a big bearing on our final MISSION 66 program.

Conservation and Protection

The new position of Chief of Conservation and Protection provides for the first time a definite representative in the Washington office for all matters pertaining to park protection. His duties cover a very broad field, overlapping into all phases of park management. He advises specifically on park ranger organizational and training matters, personnel adjustments, park protection problems and safety, service to park visitors, forestry, and maintenance.

Forestry.—Prevention and control of forest fires continued to receive major attention and, despite increased public use of the parks, a reduction was noted in the number of all types of man-caused fires except those caused by campers, and those from miscellaneous sources.

These last may be due to overcrowding which forced visitors to camp and picnic outside protected and developed sites. Total area burned and suppression costs were both below the 20-year average. Emphasis continues to be placed on training, organization, and preparedness. The Service again participated in the organization and training of the Organized Southwestern Indian Fire Fighters who have proved very effective. Our excellent forest fire record is due to the very well trained and organized ranger and forester staff.

White pine blister rust control work is near completion in most areas. It is probable that within a few years the only living forests of subalpine five-needle pine will be in the control areas of five western national parks, as no other agency is attempting to protect the species. A spot infestation of oak wilt disease, discovered in Shenandoah National Park, was promptly controlled.

Control work is done annually to protect the valuable trees in and near public use areas against forest insect infestations and to prevent development of epidemics. Southern pine beetle required control in Great Smoky Mountains, on the Blue Ridge Parkway, and on adjacent areas under a cooperative program. Spruce budworm, epidemic in Montana and Idaho, required spraying of 31,360 acres of Douglas-fir in Yellowstone. About 46,000 acres of lodgepole pine in Yosemite is under attack by an epidemic of lodgepole needleminer. No practical control method exists, so large losses may be expected. Efforts to devise a means of control are continuing.

A traveling crew of experts on tree maintenance worked in 26 eastern areas to maintain both public safety and the quality and appearance of the trees. They performed many emergency duties following hurricanes "Carol" and "Edna." This crew removed more than 1,300 hazardous trees during the year.

Maintenance

Under the new management concept, maintenance activities have been placed under the Division of Operations. Work accomplished has been principally in the fields of staffing, basic procedures, and fiscal adjustments. The objectives are to obtain maximum economy and efficiency in the use of all available resources for protection and use of the primary values of the national parks. Sound management and engineering principles are applied to all maintenance activities at all levels. Workload measurements have been used to justify very satisfactory increases in maintenance funds, and more such standards are being used as field data become available. Full application of this principle will provide a sound preventative maintenance program.

A series of Maintenance and Rehabilitation Guides have been issued for estimate and procedure matters. More are planned to guide the programing of preventative maintenance work. In the regional offices, the professional men in the Maintenance Branch have spent most of their time assisting area superintendents. In the larger parks, a staff of professional men has been provided to assist on maintenance problems. Emphasis has consistently been on helping the park superintendent to carry out his full responsibilities.

The Branch of Programs and Plans Control was started as part of the reorganization of the Service and has been in operation for a little more than a year. So far it appears that development of the System will be benefited by establishment of this Branch.

Programing

Instructions for programing development were revised to fit the operations pattern established in the reorganization of the Service. Programs are now prepared and recommended to the Director by the Division of Operations; detailed data for individual project proposal forms are the responsibility of the Division of Design and Construction. This procedure is now in operation and working satisfactorily.

A card index system for individual projects has been set up which provides ready information on programing, financing, progress, and completion of any project. At the request of the Bureau of the Budget, the "Schedule of Public Works Construction Programs," required each year for the next 6-year period, was prepared in much greater detail this year than in previous years. This gives a detailed analysis of scope, character, and location of construction projects planned by the various bureaus.

The "contract authorization" for roads and trails and parkways provided by the Congress for fiscal years 1955, 1956, and 1957 required stepping up the collection of basic data, preparation of programs and surveys, completion of plans and specifications, and getting construction work started promptly. The fact that the Service was still undergoing reorganization complicated the situation considerably, but by hard work, and with the fine cooperation of the Bureau of Public Roads, most of the difficulties were overcome, and good progress was made on the obligation of funds. The Service is now ready to handle the full amount of the contract authorization for 1956 and 1957. For contract authorization, the Programs and Plans Control Branch, with the help of the Division of Design and Construction, is preparing control schedules showing anticipated cash expenditures on projects included in a 6-year program.

Data received from the field will form the basis of current estimates of amounts needed in all areas to complete development as it is

presently planned. These reports will be the basis of all programing activities and issuance of information.

Land Acquisition and Water Rights

Land acquisition.—During the year \$1,250,000 was made available for land acquisition. Of this amount, \$500,000 was received from Jackson Hole Preserve, Inc., to match a \$500,000 appropriation which was conditioned on a matching donation. Some 17,800 acres were brought into the System by purchase, donation, or exchange.

About 3,200 acres more were acquired or optioned with approximately \$265,000 of the \$1,236,000 donated in 1952 for the Cape Hatteras National Seashore project. Approximately 23,500 of a total of 28,500 acres in the project have been acquired.

The establishment of Cumberland Gap National Historical Park is expected within a few weeks. Fee title to 515 acres of land and scenic easements was acquired from the State of West Virginia for its portion of the Harpers Ferry National Monument project. The State of Maryland is in the process of acquiring about 800 acres as its portion of the project.

Obligations on completed purchases, option contracts, and condemnation awards come to about \$6,800,000 of the \$7,700,000 appropriated for acquiring properties for Independence National Historical Park project.

A good start has been made on acquisition of the extension to Wright Brothers National Memorial, for which the Old Dominion and Avalon Foundations donated \$82,000 and the State of North Carolina \$25,000.

Donations included 3,375 acres of land and scenic easements from the State of Mississippi for Natchez Trace Parkway; 364 acres from the State of North Carolina for Blue Ridge Parkway and 73 acres from Jackson Hole Preserve, Inc., for Grand Teton National Park.

By exchange the Service acquired 160 acres in Death Valley National Monument; 2,000 acres in Joshua Tree National Monument; 1,070 acres in Olympic National Park; 2,880 acres in fee and the mineral rights in 7,690 acres in Theodore Roosevelt National Memorial Park.

Completed purchases and approved options to purchase involve a total of 3,700 acres of land and improvements thereon, costing about \$850,000, in Big Bend, Glacier, Grand Teton, Great Smoky Mountains, Kings Canyon, Lassen Volcanic, Rocky Mountain, and Yosemite National Parks; Colonial and Saratoga National Historical Parks; Gettysburg National Military Park; and Manassas National Battlefield Park. Options amounting to \$300,000 awaited approval at the end of the year.

Water-rights problems.—There was continued progress in the establishment of Federal rights to the use of water through the approximately 1,445 water systems in Service-administered areas to comply with the water laws of the individual States. By appropriation or purchase or as appurtenances to acquired inholdings, the United States has established 426 rights since 1936, appurtenant to 355 water systems. Of these, final licenses or decrees have been granted for 265, and 161 are still in permit form requiring water-system enlargement or water use by the annually increasing number of visitors, before proof for licenses or decrees can be obtained. The preparation of applications, statements of claim, and purchase negotiations to establish essential rights for 315 additional water systems continues.

Only one protest of a conflicting claim was filed, and four older protests were resolved in favor of the United States. The city of Los Angeles also withdrew its Federal power application and 10 water-right applications for development of the Kings River, Calif., thus eliminating its interest in the Tehipite and Cedar Grove areas adjoining Kings Canyon National Park, and in other sites inside the park.

Special uses of park lands.—The majority of special use permits for the past year continued to be for agricultural use of small parcels of land to maintain historical and rural scenes, for access facilities from private lands to park roads, and for utility lines.

By authority granted by this Service, the Atomic Energy Commission has continued to carry out its reconnaissance surveys for strategic minerals in areas of the System. The number of requests for information on prospecting and mining in national parks and monuments increased tremendously during the past year.

Concessions Management

Twenty-four concession contracts and 27 concession permits were negotiated in the 1955 fiscal year. In connection with new contracts, construction programs were negotiated with the Everglades Park Co., Inc., for Everglades National Park in the amount of \$250,000; Rocky Mountain National Park with the Colorado Transportation Co. for \$244,000; Millerton Lake National Recreation Area with Mack Lazarus for \$49,500; Glacier National Park with the Glacier Park Co. for \$795,000; and Grand Canyon National Park with Fred Harvey for \$1,000,000; Lake Mead National Recreation Area with Cottonwood Cove Corp., for \$150,000, and I. H. and Janice C. Whitehouse for \$235,000; and Mount Rushmore National Memorial with the Mount Rushmore National Memorial Society for \$500,000—a total of \$3,223,500.

Nine prospectuses issued during the year solicited offers to operate concession facilities at Everglades, Big Bend, and Mount McKinley

National Parks; Lehman Caves and White Sands National Monuments; Shiloh National Military Park; and Lake Mead National Recreation Area. As a result, concession permits or contracts were concluded at each of these areas, except Big Bend, where no offers have been received, and Mount McKinley National Park, for which the three offers received were not acceptable.

Of the construction programs negotiated this year, more than \$500,000 in construction and rehabilitation has been completed, and approximately \$700,000 is now under contract.

With respect to construction programs negotiated in prior years, the Grand Teton Lodge and Transportation Co. has invested more than \$5,000,000 in new facilities, completed this year, at Grand Teton National Park. Funds for this construction were supplied by Jackson Hole Preserve, Inc., the nonprofit corporation established by John D. Rockefeller, Jr. Other such investments include: Babbitt Bros., approximately \$85,000 at Grand Canyon National Park; the C. W. and G. Anderson Co., Lake Mohave Resort, Inc., and Temple Bar Resort, Inc., \$59,500, \$215,000, and \$78,100 respectively, in new facilities at Lake Mead National Recreation Area; the Lassen National Park Co., over \$100,000 in new facilities at Lassen Volcanic National Park; Becker's Ocean Resort, Inc., \$11,000 in new cabins at Olympic National Park; Rainbow Forest Lodge, \$8,500 in rehabilitation at Petrified Forest National Monument; and the Yosemite Park and Curry Co., more than \$300,000 in new facilities at Yosemite National Park.

ADMINISTRATION

Budget and Finance

Appropriations.—The cash appropriations to the Service for the 1955 fiscal year were less than for the 1954 fiscal year. However, the contracting authority for construction of roads, trails, and parkways provided by the Federal Aid Highway Act of 1954 resulted in an increase in total obligational authority for 1955 over 1954. The comparative amounts are as follows:

Appropriation item	1954 fiscal year	1955 fiscal year	Increase or decrease
Management and protection.....	\$8, 869, 550	\$9, 098, 390	+ \$228, 840
Maintenance and rehabilitation.....	8, 300, 000	8, 425, 000	+ 125, 000
General administrative expenses.....	1, 268, 000	1, 084, 000	— 184, 000
Construction.....	13, 916, 300	13, 618, 200	— 298, 100
Construction (liquidation of contract authority).....	1, 500, 000	-----	— 1, 500, 000
Total appropriations.....	33, 853, 850	32, 225, 590	— 1, 628, 260
Construction (unfunded contract authority for roads, trails, and parkways).....	-----	10, 500, 000	+ 10, 500, 000
Total obligational authority.....	33, 853, 850	42, 725, 590	+ 8, 871, 740

Visitor fees.—In accordance with the policies set forth in Title V—Fees and Charges (Public Law 137, 82d Cong.), an extensive system of visitor fees is maintained to cover, in part, the cost of services and facilities furnished park visitors. The revenue from the fees is deposited to the general fund of the Treasury and partially offsets appropriations to the Service, thereby reducing the burden on the general taxpayer. At the request of the Secretary a comprehensive survey of visitor fees was made during the past year. This took into consideration the cost to the Government of providing the services and facilities, the value to the recipient, and the public interests served. The recommendations resulting from the survey would substantially increase Service revenue but action on them is being held in abeyance pending congressional action on proposed fees for the Blue Ridge Parkway. For the parkway the Service planned to establish a fee of \$1 for a 15-day automobile permit and \$2 for an annual permit. The collection of the fees was deferred at the request of the House Subcommittee on Appropriations until it could consider the proposal. It is expected that the Committee's action on the Blue Ridge Parkway fees will have an important bearing on future fee proposals.

The elevator and guide fee at Carlsbad Caverns National Park, N. Mex., was increased from \$1.10 to \$1.50 effective June 25, 1955, the date the new express elevator facilities were made available for visitor use. The increased revenues will amortize the capital investment made by the Government in constructing the facilities in accordance with an understanding with the congressional Appropriation Committees.

Revenues.—The Service has been losing substantial amounts of revenue for several years because it could not man entrance stations and other collection points during the full time it was productive to do so. Sufficient funds were appropriated by the Congress for 1955 to provide for 306 additional seasonal uniformed personnel. As a result of the additional personnel, the continued increase in park visitors, and upward revisions in the fee structure, visitor revenue for the 1955 fiscal year went from \$3,274,997 to \$3,929,496, or an increase of \$654,499. A comparative statement of all park revenues for the 1954 and 1955 fiscal years is as follows:

Revenue source	1954 fiscal year	1955 fiscal year	Increase or decrease
Visitor fees	\$3, 274, 997	\$3, 929, 496	+\$654, 499
Business concessions	493, 448	412, 702	—80, 746
Sale of property and products	142, 956	192, 778	+49, 822
All other sources	128, 498	216, 343	+87, 845
Total	4, 039, 899	4, 751, 319	+711, 420

Consolidation of field accounting offices.—The Service consolidated and reduced the number of its field accounting offices from 48 to 28 as a result of a joint survey made by representatives of the Department, the General Accounting Office, and the Service. The consolidation eliminated 24 positions and effected a savings of \$92,000 which is being used for more productive field work. Each employee affected was given an opportunity to transfer to existing vacancies elsewhere in the Service. However, a few terminations were necessary.

Personnel Management

Heavy workload caused by shifts.—The most significant problem faced by the Branch of Personnel in the past fiscal year was the continuing heavy workload brought about by the reorganization of the Service. An extraordinarily large number of shifts of personnel continued to be made throughout the fiscal year, largely as a result of chain reactions set up by movements among top positions in the Regional offices and the Washington office. These shifts of personnel received a new impetus in the second half of the fiscal year in connection with staffing the new Region Five office at Philadelphia, Pa., and the 28 field accounting offices set up in lieu of a larger number of such offices as a result of a special study.

Position studies justify upgrading.—A completed project of great importance to the Service was a classification study of superintendent positions. This resulted in the preparation of tentative allocation standards for these very important positions, and resulted in upward reclassification of the great majority of them. Another completed study of considerable magnitude concerned the chief clerk and administrative officer positions, and positions subordinate to them. A large percentage of the chief clerk positions were also upgraded as a result of the study, and the title "chief clerk," which had been in use since the Service came into being, was abandoned in favor of the title "administrative officer." The superintendent and administrative officer reclassifications have improved the grade structure of the Service tremendously, have opened the way to its further improvement, and have resulted in noticeable uplift in the morale of field employees.

New handbook.—To keep all employees better informed, as well as to improve the orientation training of new employees, a completely new employee handbook was produced and distributed to all permanent employees near the end of the fiscal year.

Recruiting seasonal employees.—In the preceding fiscal year, procedures newly established by the Civil Service Commission required the recruiting of seasonal rangers through the competitive examination process. With very strong help from the Office of the Secretary,

the Service obtained Civil Service Commission approval to place these seasonal positions under schedule A for recruiting purposes this year. Reports from several important field areas received by the end of the year indicate that recruitment of the seasonal uniformed staff proceeded much more efficiently, economically, and rapidly this year than was the case last year under the examination process. Although it is too early to compare the results of recruitment with the results obtained last year, early indications are that the quality of recruits is more satisfactory this year than last.

New regional directors.—Hugh M. Miller, who began his career with the National Park Service in 1931 as an assistant clerk at Wind Cave National Park, was promoted to the position of regional director, Region Three, to succeed Miner R. Tillotson, who died on February 28 after more than 14 years in that position. Miller had previously been assistant regional director. Daniel J. Tobin, whose first employment with the service was as a clerk in Sequoia National Park, and who has been assistant regional director in Region One for the past 3 years, was selected to fill the new position of regional director, Region Five, scheduled for establishment on July 1, 1955, with Philadelphia as headquarters.

Employee training.—As a means of serving the public more effectively and making more effective use of our human resources, employee training continued to receive more and more emphasis. In this connection, an experimental Washington office general in-service training course was conducted for 18 employees through a 13-week period to acquaint the participants with the activities of the various segments of the Washington office, as well as to give them greater familiarity with field operations.

The agenda for an approved preseason training program for seasonal public contact personnel was developed and distributed to the field.

The 13th general administration training course was conducted in the Region One office from November 29 to December 10, 1954, with 27 selected field employees in attendance. The 14th course was conducted in the Region Three office from April 25 to May 6, 1955, for 21 employees. A total of 341 carefully selected employees have undergone this type of intensive administrative training since it was started in 1940.

Safety

Visitor-accident fatalities.—It is considered of some importance that visitors not only enjoy and obtain the benefits of knowledge and inspiration which the areas of the National Park System offer, but also that they do so safely. For the calendar year 1954 visitor-accident

fatalities were found to be in the ratio of less than one per million visitors. Motor-vehicle accidents and drownings were the leading causes of visitor-accident fatalities.

At the request of the Federal Fire Council, the Service prepared a letter to the Comptroller General which includes suggested language for use in specifications to permit all agencies of the Federal Government to purchase approved equipment and appliances based upon tests by recognized testing laboratories. The letter has been sent by the council to the Comptroller General who, in 1954, had ruled that the requirement that equipment bear the label of the Underwriters' Laboratories is restrictive.

Records Management

The Branch of Office Services has, during the past year, gained approval of and made distribution to all field offices for mandatory application a comprehensive records disposal schedule. Reports received to date indicate that field offices are now using the schedule to dispose of or to retire accumulations of records peculiar to the Service which have been held through the years for lack of disposal authority.

DESIGN AND CONSTRUCTION

The efforts of the Division of Design and Construction during the past year have been predominantly directed toward construction for improved public service facilities, concessions, and interpretive activities.

Buildings, Utilities, and Grounds

Service construction.—Construction activities have been concentrated on the installation of buildings and utilities, to alleviate the critical shortages of accommodations and interpretive facilities. The Service is engaged in the following construction projects and has funds with which to continue them:

At Mount Rushmore National Memorial—a concessioner's dormitory for 64 persons, a concessions building, and an amphitheater; at Grand Canyon—a public service building containing an information office, a collection-storage-work office, patio, museum, library, and restrooms, on the new south approach road; at Carlsbad Caverns—a public-use building and elevator lobby, museum, and naturalists' offices; at Isle Royale—multiple-unit overnight accommodations at Rock Harbor; at Grand Teton—campground developments at Colter Bay; at Yellowstone, campground developments at Canyon; at Colonial—public information centers at Yorktown and Jamestown; at Gillespie Gap on the Blue Ridge Parkway—the Museum of North

Carolina Minerals. These and other similar projects will cost about \$5 million.

Concessioner construction.—The facilities listed above will be augmented by the following concessioners' development projects for new overnight accommodations which are completed or under way:

In Yosemite Valley—a registration office and new lodge containing a lobby and cafeteria; at Shenandoah—a registration office and lobby at Skyland; at Everglades—a day-use building with lobby and dining room, a boat servicing-and-rental building, and shelters at Flamingo; at Grand Teton—the newly completed Jackson Lake Lodge, which will accommodate 1,000 guests, and the proposed moderate-price accommodations at Colter Bay which will accommodate 600, with stores, shops, studio, dining room and cafeteria, fountain and snack bar for the cabin occupants and for the 1,200 persons who will occupy the Colter Bay campgrounds and trailer camp.

Other Service developments.—At Carlsbad Caverns National Park two new elevators have been completed and placed in service. There and at Mammoth Cave National Park and Oregon Caves National Monument, cave wiring has been modernized and improved.

New water and sewer systems, parking areas, roads, trails, and comfort stations to serve new or expanded campgrounds and picnic grounds have been completed in more than 25 areas. Successful negotiations and contracts for the introduction of commercial power or communications service or both have been concluded at 10 areas, to the definite benefit of the Service and the public. New or improved radio communication systems have been installed at 4 areas.

The construction of administrative, protective, and maintenance facilities and employee housing continues at much too slow a rate. To bring the public-use facilities up to reasonable requirements, at least \$10 million will be needed for the next 10 years. However, Mission 66 when completed will give a more accurate figure.

Two studies.—Of notable interest and value has been the completion of two cooperative studies by the Public Health Service. The first and most far-reaching produced a detailed tabulation and report of "urgent," "necessary," and "desirable" sanitary engineering needs of the areas administered by the National Park Service. The second and equally valuable study is devoted to the problems of storage, collection, and disposal of garbage and trash. This involves a thorough analysis of current procedures in several of the major parks.

Park Roads, Trails, and Parkways

With respect to major roads construction, there has been notable progress toward completion of roads started many years ago, in consummating agreements of transfer affecting approach roads and other

primary State routes, and in advancing construction on other roads. This has been made possible by contract authorization for 1955, 1956, and 1957 and by increased appropriations for 1955—\$10,000,000 compared to \$4,000,000 in 1954. The contract authorization for 1956 and 1957 is \$12,500,000. These authorizations should be stepped up to \$20,000,000 during the next 10 years to complete our program.

At Grand Canyon, the south approach and entrance road was completed; at Grand Teton, final paving has been completed on the 18.5 miles of road from Moran to the south entrance of Yellowstone; at Shenandoah, the paving of 48 miles of the Skyline Drive was begun, to complete the paving of the entire 105 miles, started several years ago. Construction of the 29-mile Zion-Bryce Canyon approach road has been completed and the road is to be transferred to the State of Utah for maintenance.

Work has been started on the 5 miles of the Shiloh-Corinth Road which lies in Mississippi. When completed this will be taken over by the State. Yellowstone Park route known as the Gallatin Road is being built in stages by the State of Montana, which will maintain it on a permit basis.

Good progress is being made on grading, tunnel excavating, and base surfacing on the 13-mile Heart o' the Hills Road in Olympic National Park. At Mount Rainer, there is similar progress to be reported on the 18-mile Stevens Canyon Road, so that completion may be expected with the work programed for 1956. At Kings Canyon, major structures and other work on 9 miles of the road from the end of State Route 180 at Deer Cove Creek to the terminal loop at Copper Creek will be completed in 1956 and 1957.

Parkway Construction

In the fiscal year 1955, the Service received \$10 million in appropriations and contract authorization to continue construction on the several parkways. We have contractual authorization for 1956 and 1957 of \$11 million per year. Like our road and trail item, this should also be increased. We hope that we can get this contract authorization increased to \$17 million during the next 10 years.

Blue Ridge Parkway.—By the end of the year, work in progress on the Blue Ridge totaled \$2,816,500 in major construction contracts. These included the grading and bridge structures to complete the 10-mile gap between the end of present construction south of U. S. 60 and the James River. The James River Bridge, to be programed in 1957, will close the only gap between Shenandoah National Park and U. S. 460 near Roanoke, Va., a distance of 108 miles. A 3-mile unit in North Carolina near Blowing Rock, started with funds appropriated pre-

viously, and including grading and a grade separation over U. S. 321, was completed. The grading and surface treatment of 11 miles between Wagon Road and Beech Gaps, west of Asheville, started before World War II, were also completed, as was the \$90,500 grade separation over U. S. 58, at Tuggles Gap, in Virginia.

Colonial Parkway.—Construction under contracts totaling \$2,129,420 was in progress by the end of the year, primarily on the 9-mile portion of the parkway between Williamsburg and Jamestown Island and at the parkway terminus at Yorktown. This work is on a tight construction schedule in order to complete the parkway in time for the 1957 celebration.

Natchez Trace Parkway.—On the Natchez Trace, \$1,679,440 worth of major construction was under way by the end of the year. Contracts included the grading of 13 miles in the vicinity of Mathiston, Miss., to complete a continuous 102-mile parkway unit from Ridgeland, near Jackson, to U. S. 82, near Mathiston. Fifteen miles are being paved; when this is completed the southern 79 miles of the 102-mile unit will be continuous pavement. During the year, 34 miles of continuous paving were opened to use and an overpass over the Frisco Railroad near Tupelo, Miss., was completed. The cost of these two projects was \$640,190.

Baltimore-Washington Parkway.—This parkway, of which 19 miles is Federal, and which connects with the District of Columbia street system, was officially opened to public use last October. The 1955 appropriation contained no funds for it, but contracts amounting to \$1,930,240, for 9 miles of paving, guard rail, and traffic signs, were completed.

General.—About \$900,000 worth of public service facilities of various kinds were under construction at the end of the year. Work was started on the stabilization of Mount Locust, near Natchez, one of the oldest structures in Mississippi which served as an overnight stand on the historic Natchez Trace.

The Mississippi River Parkway project.—This project is now in the planning stages in several of the 10 States involved. The National Park Service has participated with the Bureau of Public Roads in assisting the States of Illinois and Minnesota in planning the land acquisition and right-of-way development, including the determination of boundaries, in accordance with the terms of the 1954 Federal Aid Highway Act.

Plan Preparation

The preparation of plans has involved principally keeping pace with the construction programs of the Service and park concession-

ers. It is possible also to report progress on the preparation of first editions of master plans for new and prospective areas such as Coronado National Memorial, Harpers Ferry National Monument, Cumberland Gap National Historical Park, Cape Hatteras National Seashore, and Fort Caroline National Memorial, as well as for Fort Washington, a unit of the National Capital Parks.

Personnel

Student assistant training program.—The program for the systematic employment of promising students majoring in landscape architecture, architecture, and engineering during summer vacations after their sophomore and junior years has been continued; more than 80 will be employed by the Service this summer. Their duties are to assist in preparing master plans, conduct surveys, and make plans for construction projects.

Recruitment.—The eastern office of Design and Construction is at approximately 65 percent of ceiling strength; the western office at 70 percent. It has been difficult to obtain qualified professional personnel at present authorized salary rates.

COOPERATIVE ACTIVITIES

Changes in the National Park System

Proposed new areas.—No new areas were established or authorized during the year but progress was made on several proposals. Bills to authorize the establishment of a Virgin Islands National Park were introduced in Congress and hearings were held on them. Mr. Laurance Rockefeller has offered to acquire and donate to the Federal Government the necessary lands for this proposed park on the island of St. John. A bill was pending to authorize the City of Refuge National Historical Park in Hawaii. Cooperative agreements were under consideration whereby Chimney Rock in Nebraska and Promontory Summit in Utah might be designated National Historic Sites in non-Federal ownership. Sponsors made good progress toward provision of lands and road rights-of-way for the proposed Fort Union National Monument in New Mexico, which was authorized by Congress in 1954.

Area abolishments.—The Service has adopted a program to eliminate from the National Park System those few areas which are considered to be primarily of State or local significance. Bills were introduced in Congress to disestablish the following national monuments: Castle Pinckney in South Carolina, Fossil Cycad in South Dakota, Old Kasaan in Alaska, and Verendrye in North Dakota.

Boundary adjustments.—Without impairing monument values, 29,118 acres were excluded from Glacier Bay National Monument in Alaska by Presidential proclamation. Bills, favored by the Service, were introduced in Congress to revise the boundaries of Theodore Roosevelt National Memorial Park, and Devils Tower and Pipestone National Monuments. A bill to delete lands from the eastern side of Mount McKinley National Park, Alaska, was considered detrimental. The Service studied the following areas in order to determine better boundary lines: Carlsbad Caverns, Everglades, Grand Canyon, Kings Canyon, Lassen Volcanic, Mount McKinley, Sequoia, and Yosemite National Parks; Badlands, Fort Vancouver, Grand Canyon, Great Sand Dunes, Katmai, Oregon Caves, and Petrified Forest National Monuments; and Lake Mead National Recreation Area. In most cases boundary adjustments, involving both additions and deletions of lands, will require legislation.

Threats averted.—The Corps of Engineers concluded that protection against floods on the Snake River could be obtained without constructing levees within Grand Teton National Park; the Department of the Navy dropped its proposal to use a considerable portion of Death Valley National Monument as part of an aerial gunnery range; and a request to erect a television transmitter on the top of Scotts Bluff in Scotts Bluff National Monument was denied by the Director, whose action was later approved by the Department.

Special studies.—Cooperative scientific field studies in Katmai National Monument, Alaska, begun in 1953, were completed in 1954. Scientists from several Federal agencies and State universities participated in agricultural, archeological, biological, geographical and geological studies, and their reports are being prepared. Other special studies included: Agricultural and biological studies at Glacier Bay National Monument; geological, paleontological, wildlife, and grassland studies of Badlands National Monument; and a wildlife study of Mount McKinley National Park.

State Cooperation

Advisory service.—Advisory and consultative assistance on a wide variety of park and recreation problems was furnished to 47 of the States and Territories on 219 occasions. Among the more significant examples were, (1) participation in field studies and recommendations for a program of forest management in Itasca and St. Croix State Parks in Minnesota, (2) assistance to the State Historical Society of North Dakota in programing development of the International Peace Garden, (3) evaluation of the State park situation in Nevada to provide data for consideration by the legislature, which reactivated the

State park commission and appropriated funds for State park purposes, (4) assistance given to Alaska officials in preparing legislation designed to advance Territorial park and recreation programs, (5) technical advice to the Washington State Parks and Recreation Commission on restoration problems at Fort Simcoe State Park, (6) a field reconnaissance of a portion of the gulf coast and recommendations to the Texas State Parks Board on lands to be included in the proposed State Beach Park, and (7) advice to the Institute of Government, North Carolina, concerning organization for administration of historical properties.

Surplus property disposal.—Investigations were made of 11 surplus Federal properties totaling 733 acres requested by State and local agencies in 8 States and the Territory of Hawaii for park, recreation, and historic monument purposes, and recommendations were furnished to the General Services Administration and other disposal agencies.

The volume of work relating to determination and enforcement of compliance with the terms of the deeds of conveyance has increased appreciably. It will continue to do so, since this responsibility remains for a period of 20 years on each property or until the unamortized balance is paid. In addition to reviewing biennial reports submitted by the grantees and making occasional field inspections, the Service is called upon to grant changes in the conditions of the deeds, approve sale and exchange of lands, and accept payments of unamortized balances which free the grantees from use restrictions.

Following enactment of Public Law 387, approved June 4, 1954, amending the 1926 Recreation Act in several important respects, an arrangement was made with the Bureau of Land Management to handle, at the field level, all investigations and review of applications for public domain lands for park and recreation purposes. Reports on 10 such applications were made during the year.

Permission was granted to the Virginia Department of Conservation and Development to use approximately 100 acres of Pocahontas State Park (formerly Swift Creek Recreational Demonstration Area) for a prison labor camp to undertake conservation and highway projects.

Publications.—State Park Statistics—1954 shows a total of 1,968 State parks and related recreation areas containing more than 5 million acres; expenditures of \$17,488,000 for capital improvements and \$31,646,000 for operation and maintenance; attendance of more than 165,000,000; 5,096 year-round employees; and acquisition of 50 new areas and additions to 90 others, totaling more than 91,000 acres.

Other publications include State Park Fees and Charges, A Recreation Program for Alaska, and Recreation in Anchorage. The Digest

of Laws Relating to State Parks, prepared by Flavel Shurtleff, counsel for the American Planning and Civic Association, under contract with the Service, was published by the National Conference on State Parks.

River basin and regional studies program.—In cooperation with State and local park agencies, the Service completed 20 recreation planning reports for Bureau of Reclamation reservoir projects and a complete recreation master plan for the Nimbus Reservoir in California. In addition, assistance was given to the Bureau in the negotiation of 10 reservoir management agreements with State and local agencies under which the State and local agencies will manage recreation areas of State and local importance. A report draft on the American River Basin, embracing 20 proposed reservoirs, 6 diversion pools, and several forebays was also completed.

Two studies and reports were made for the Corps of Engineers and 26 applications to the Federal Power Commission were reviewed in connection with the preparation of the Department's comments on them to the Commission. (The Federal Power Act requires the Commission to consider recreation among other beneficial uses when approving power projects.)

The end of the fiscal year saw completion of the Arkansas-White-Red River Basins and the New England-New York region recreation surveys. These 4-year projects were part of comprehensive resources studies conducted by Inter-Agency Committees established by the President. Several Federal agencies and each of the States concerned were represented on the Committees.

The AWR report recommends development of 39 day-use recreation areas on reservoir projects and of 29 areas primarily for weekend and vacation use. The report identifies 32 important historic sites and recommends their preservation in public ownership or by qualified quasi-public agencies. Four ecological areas with high scenic or scientific values are also identified in the report.

The New England-New York region report evaluates the recreation opportunities, or in some cases the damage that would result in existing recreation values, from construction of possible reservoirs inventoried by the Corps of Engineers. The report specifically urges that projects be not considered which would spoil the fine fishing, canoeing, and camping on the St. John and Allagash Rivers in Maine, which are widely known for their wilderness characteristics.

Satisfying progress was made on the Missouri River Basin Recreation Survey. Inventories of existing scenic, scientific, historic, and other recreational areas were completed. Publication of the full report is expected by January 1957. An archeological study and report

on the basin was completed under a research contract with the University of Utah.

A survey of group camping needs in central Washington was completed by the School of Physical Education, Recreation, and Athletics of the State College of Washington, under contract with the Service. The survey was instituted as a pilot study to be used as a basis for further studies in the camping field.

Through the efforts of the Columbia Basin Commission, an advisory committee was appointed to represent the interests of the several communities around the Coulee Dam National Recreation Area. The committee will also advise the superintendent about priorities for the most desired and needed types of physical developments in the area.

INTEGRATED AUDITING

The internal audit program recommended by Administrative Assistant Secretary Beasley in April 1954 was placed in effect immediately, and audits were conducted throughout the 1955 fiscal year on this basis. The changed program provided for the integration of the auditing of businesses operating in the parks and auditing of the Service's own operations. The integrated program provided greater coverage of operations on an audit-cycle basis.

The change in the audit program and the fact that other Government agencies were offering positions one and two grades above that authorized for similar positions in the Service caused considerable turnover in the Service's audit staff. The difficulty of recruiting auditors at the grade levels authorized slowed the work; however, the cycle of audits scheduled is expected to be accomplished provided personnel turnover is at a minimum during the coming fiscal year.

The manuals used by this Service, covering both commercial auditing and governmental auditing were loaned to other bureaus and agencies at the suggestion of the accounting staff of the Office of the Administrative Assistant Secretary. It was believed these manuals would help these agencies in establishing audit programs similar to that in effect in this Service.

Difficulties in connection with the accounts and records of commercial operations in the park areas continue to be a problem. In two instances involving large claims, the auditors were forced, because of inadequate records, to spend considerably more than the estimated audit time in establishing inventory quantities, pricing inventories established, and determining ownership of assets, claims of creditors, and amounts of franchise fees due the Government.

Claims of the Government against two former concessioners resulting from prior audits which are still not settled by the Department of Justice amount to \$54,765.71 and \$25,074.15.

THE PARKS OF THE NATIONAL CAPITAL

The dedication of the United States Marine Corps War Memorial depicting the historic Mount Suribachi flag-raising scene on Iwo Jima and the opening of the 19-mile Federal portion of the Baltimore-Washington Parkway were significant events in the National Capital Park system during the 1955 fiscal year. By act of Congress, approved June 29, 1955, the name of the Lee Mansion National Memorial was changed to Custis-Lee Mansion and the area designated by law as a permanent memorial to Robert E. Lee.

The completion of the reconstruction of Beach Drive in Rock Creek Park north of Military Road and between Tilden Street and Blagden Avenue were notable improvements to this largest and most important unit of the parks in the Nation's Capital. Off-street parking along both reconstructed sections of the drive, a new public comfort station near Pierce Mill, substantial progress on a culvert for flood control at the Beach Drive-Military Road intersection, and the completion of a stable for mounted police were also important Rock Creek Park accomplishments during the 1955 fiscal year.

The installation of a new and improved two-way radio system for the United States Park Police makes possible, for the first time, communication with motorcycle mounted police as well as cruiser personnel.

The study to determine the most appropriate treatment for the preservation and interpretation of Ford's Theater, together with an estimate of the costs involved, was completed as required by Public Law 372. A prospectus for a Visitors Reception Center in the Nation's Capital was prepared; a preliminary study of new floodlighting for the Washington Monument was approved by the Fine Arts Commission; the pillow from the bed upon which Abraham Lincoln died and a George Washington Parke Custis bed were important acquisitions of original historic objects for the House Where Lincoln Died and the Custis-Lee Mansion.

A quarter of a million people saw the productions staged at Carter Barron Amphitheater during the 1954 summer season. The program featured light opera, the National Symphony Orchestra, ballet, a New York musical, and an ice show. The theater was operated without loss which gives some assurance of the long-term continuation of this popular cultural feature of the National Capital Parks outdoor recreation program.

The beautiful American elms which have been an important feature of the Washington parks for generations are now threatened by the elm scorch as well as the Dutch elm disease. Control of both diseases requires the removal and burning of the infected trees. More than 500 elms were victims of the two diseases during the year, including

many towering specimens on the Ellipse and elsewhere in the central area of the Nation's Capital. Hurricane Hazel and the continued dry weather of the past 2 years have also taken a heavy toll of the trees in the park system. Both park improvements and regular maintenance have suffered from the necessity of applying more man-days for tree removal, pruning, feeding, and watering.

Mountain climbing.—Grand Teton, Mount McKinley, Mount Rainier, Olympic, Rocky Mountain, Glacier, Sequoia, Kings Canyon, Yosemite, and Zion National Parks and Devils Tower National Monument are the important mountain climbing areas of the System, offering serious rock work. Growing public consciousness of the need of safety precautions and safe practices is reflected in the general decline in mountain-climbing casualties.

Fred B. Ford, Jr., a guide with the Petzoldt-Exum Climbing Guide Service at Grand Teton, was killed in June in the course of a Grand Teton climb, first hit by a falling rock then, while waiting rescue, falling about 1,000 feet. The recovery of his body and the rescue of one of his charges in blizzard conditions on the upper slopes of the peak was one of the most dangerous and heroic in national park annals, participated in by both Service and other skilled mountaineers.

The Advisory Board.—Secretary McKay appointed Carl I. Wheat, distinguished attorney of San Francisco and Washington, D. C., and Dr. E. Raymond Hall, chairman of the University of Kansas Department of Zoology, to membership on the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments. They succeeded Dr. Harold E. Anthony, dean of the American Museum of Natural History scientific staff, and Dr. Theodore C. Blegen, dean of the University of Minnesota Graduate School, both of whom had given exceptional service to the board.

Boy Scout award winners visit two parks.—Twelve Explorer Scouts, regional winners of Boy Scout Conservation Good Turn Awards, in the course of a western trip in June and early July to see "conservation in action," visited Grand Teton and Yellowstone National Parks. Two days of their stay in Yellowstone was spent on a "campout" on Peale Island, in Yellowstone Lake.

OFFICE OF TERRITORIES

Anthony T. Lausi, *Director*



THE Office of Territories, with one of the smallest headquarters staffs among Federal agencies in Washington, watches over an astonishing variety of activities, in Territorial areas spread over two great oceans. These activities vary in each Territory. Altogether they include political administration, economic development directly and through aid to private enterprise, large health and education programs, and aid in securing Federal legislation beneficial to the Territories.

In the field of government the Office supervises political activities in some island areas new to the customs and practices of democratic institutions. In others, where there has been long experience with these institutions the Office has no direct political functions but aids Territorial governors and their staffs in maintaining their relationships with the Federal Government.

In the economic field the Office operates a hundred-million-dollar railroad in Alaska, builds and maintains a huge network of roads in that Territory and administers an Alaska public works program.

In the Pacific the Office promotes sea and air transportation and in many ways aids and encourages agricultural, industrial and business development. In the Caribbean it has administered economic aid programs which have been liquidated as fast as private enterprise and Territorial local government units have been in a position to assume their proper responsibilities.

In the field of public health and education, the Office either builds and maintains needed facilities or promotes their development by Territorial governments.

The fiscal year, ended June 30, 1955, has seen marked improvement in the businesslike administration of these Federal functions in the Territories for which the Office of Territories is responsible. The Alaska Railroad has closed the year with a \$2,600,000 surplus over expenses of operation, and has improved the transportation services

provided shippers at the same time that expenses have been decreased. While the operation of a military pipeline from Haines to Fairbanks will cause an important reduction in revenues, every effort is being made to meet the financial problems which this loss in revenue will entail. Plans were far advanced for a seatrain service to Alaska to be operated by a large ocean carrier.

The Alaska Road Commission completed in 1955 its fiftieth year of service to the Territories in building and maintaining Alaska's road system. The paving program, which has already black topped hundreds of miles of through highways, was greatly advanced and winter maintenance activities expanded.

The Alaska and Virgin Islands public works programs have continued to supply much needed schools, utilities and other public improvements. The Virgin Islands program, however, under the Revised Organic Act, will be turned over to a reorganized Territorial government.

Plans were far advanced, through drafts of proposed Federal legislation, to transfer to the Territory of Alaska the care of Alaska mental patients, which, for many years, has been an Office of Territories function.

In the Pacific Islands the fiscal year has brought improved administration of government affairs, and economic development where such development has been sorely needed. In American Samoa, a draft constitution has been partially completed. Samoan annual exports were doubled through the operation of a government fish cannery leased to private interests. In Guam tax collections have been very greatly increased and important gains made in a program of public improvements.

In the Trust Territory of the Pacific Islands the centralization of headquarters supervision in Guam rather than Honolulu has brought marked improvement in administrative efficiency. The granting of a charter to the Palau Congress and the selection of a Micronesian to fill the post of District Education Administrator have been milestones in the evolution of island self-government. This is the first time in the history of American administration of the Trust Territory that a Micronesian has occupied a district official post.

The fiscal year saw another setback in the long-continued fight for statehood for Hawaii. Legislation providing statehood for both the Territories of Alaska and Hawaii was introduced into the House and Senate and both the Senate and House Committees on Interior and Insular Affairs held statehood hearings. The House committee reported out H. R. 2535 which would have granted statehood to Alaska as well as Hawaii. The House of Representatives voted to recommit the bill and no further action was taken by the Congress before the close of the legislative session.

In the pages that follow there is presented a more detailed picture of the many-sided activities of the Office of Territories.

ALASKA

Cooperation in Resource Development

Alaska's greatest need, now as in the past, is economic development based on the enterprise of her citizens. Because of huge Federal land holdings in the Territory there is no area of the United States in which there is more opportunity for wise Federal cooperation in meeting this need.

The first year of operation of the new pulp mill at Ketchikan provided additional year-round employment in southeastern Alaska and greatly increased the output of timber products from the Tongass National Forest. Additional large pulp mills and sawmills for the utilization of Alaska's vast timber resources are being planned at Wrangell, Sitka, and Juneau.

In addition to the loggers employed by the Ketchikan pulp mill the company is purchasing logs from around 50 independent loggers whose operations are conducted in almost every area of southeastern Alaska. This means that Ketchikan Pulp Co. paychecks are going into the smaller communities of Alaska and are having a stabilizing effect on the economy of these communities.

The fiscal year saw an amazing growth of interest in the possibility of oil production in Alaska. The Bureau of Land Management issued oil exploration leases covering more than half a million acres, and drilling was actively underway in areas around Cook Inlet and in the coast area east of Cordova.

The Department in the latter part of the fiscal year requested the views of the Senate and House Committees on Interior and Insular Affairs and the House and Senate Armed Forces Committees on the possible revocation of those portions of Public Land Order 82 applying to 25 million acres of land outside of Naval Petroleum Reserve No. 4 in northern Alaska. The Department of the Navy has advised that it has no objection to revoking Public Land Order 82 provided that the proposed revocation does not affect the present status of the lands in the Naval Reserve.

In order to promote the basic economic development of Alaska a resource development board was created by the Territorial Legislature. This board will foster and coordinate programs, for the use and management of Alaska's natural and other resources, for the promotion of general economic development, and for the provision of transportation facilities and other public works and facilities essential to such development.

Alaska Railroad Forges Ahead

The Alaska Railroad closed its books for the fiscal year 1955 with one of the brightest financial reports in its history. Net income amounted to \$2,617,278.72 as compared with \$719,524.65 in the previous fiscal year. It is highly significant that this record was achieved through economies that were accompanied by a noteworthy improvement in the services rendered to shippers.

On the unfavorable side is the fact that the military pipeline from Haines to Fairbanks is scheduled to begin operation shortly after the beginning of the next fiscal year. This will reduce by 80 percent railroad revenues presently derived from the movement of bulk petroleum products north of the Alaska Range. The railroad is attempting, in discussions with military authorities, to regain some of the threatened loss of tonnage in order to maintain the potential ability of the railroad to move large volumes of petroleum products in time of emergency. Other efforts will be made to achieve further economies and to attract additional commercial shipping to the Railroad. However, in the absence of counteracting factors which cannot be foreseen at present, the Railroad must face the inevitability of a decline in net revenue during the next fiscal year.

Though substantial sums have been appropriated by Congress for the rehabilitation of the Railroad in previous fiscal years much remains to be done in the way of ballasting, replacing untreated ties with treated ties, and grading of roadbed. The rehabilitation program will be continued but costs in connection therewith will be met from earnings. Crushed ballast will be utilized in lieu of pit run material to provide better drainage and smoother riding track. Field forces will be mechanized further in line with latest railroad practices, to increase production during the limited working season and to improve the quality of the work.

The rehabilitation of the roadway between Seward and Portage, being performed under contract, was 37 percent complete at the close of the fiscal year, with final completion scheduled for the second quarter of fiscal year 1956. At the close of the year plans were completed for awarding a contract for the construction of a new ocean dock at Seward.

As part of a major program for the retirement and replacement of obsolete and outmoded equipment, an order was placed for 100 multi-service ballast cars, 54 of which have been delivered, and specifications have been prepared for the acquisition of 50 flat cars equipped for handling large cargo vans. This latter feature should prove mutually advantageous to both the Railroad and motor carriers.

Negotiations are under way for the acquisition of nine lift vans for transportation of cold storage items under controlled temperatures.

Plans are being developed also for the procurement of two Pullman cars upon receipt of which overnight sleeper service between Anchorage and Fairbanks will be provided.

Turn-around freight service between Anchorage and Seward has been inaugurated. This permits centralization of maintenance in Anchorage while the running time of freight trains between Anchorage and Fairbanks has been reduced to 22 hours. Further reduction to a 20-hour schedule will be made within a short time.

River boat operations by the Railroad were discontinued on March 1, 1955, when a 20-year contract was negotiated with the B. & R. Tug and Barge Co. of Kotzebue, Alaska, doing business as the Yutana Barge Line. This permitted the Railroad to meet an administration objective to retire from an unnecessary Federal operation when a contract carrier can be found to perform the service at a reasonable price.

As part of a major program to reduce railroad inventories, the General Services Administration assumed direction of a project to dispose of war surplus materials having an estimated acquisition value of \$3,900,000. Realization from sales amounted to about \$500,000 with costs incident to the program amounting to approximately \$80,000.

At the close of the fiscal year the railroad signed an agreement with the Alaska Steamship Co. which looks to the inauguration of seatrains service to Alaska. Specially designed car ferries will be built for this service, which it is proposed to begin within 2 years. Such an operation will mark a revolutionary change in freight transportation to and from Alaska.

Alaska Road Commission Completes Fiftieth Year

During the fiscal year the Alaska Road Commission completed half a century of service to Alaska, an occasion marked by appropriate ceremonies at Juneau. Created by act of Congress as an agency of the War Department in 1905, and transferred to the Department of the Interior in 1932, the Commission has administered the major portion of the Territory's highway development program from its inception.

As of June 30, 1955, the highway system of Alaska totaled 3,543.5 miles, of which 2,174 miles were maintained open the year-round, plus 248 miles of trails. The primary or through system, consisting of the Richardson, Alaska, Glenn, Seward-Anchorage, and Haines Highways, is approximately 80 percent paved. The balance is scheduled for paving in the immediate future. This system connects Alaska's principal cities, seaports and military installations with one another and with the continental United States via the Alaska Highway through Canada.

Principal projects active during the year include:

Glenn Highway.—The 189-mile portion of this route from Anchorage to Glennallen Junction is paved. Of the 125-mile Tok Cutoff portion from Gulkana Junction to Tok all but 35 miles are paved. At the close of the year contracts for paving this final section, and for construction of five bridges on this route, were active.

Alaska Highway.—Late in the year a contract was awarded for reconstruction of the final 44 mile section of this 207-mile route. This section, and an additional 30-mile section, are scheduled for early paving. The remaining 133 miles are paved. In addition six bridges were under contract construction at the close of the year.

Richardson Highway.—Paving of 221 of this route's 365 miles is complete. Two contracts, for paving a total of an additional 104 miles, are active. A contract for paving the final 40-mile section is scheduled for award in the near future.

Copper River Highway.—A contract to advance the roadway being constructed on the abandoned Copper River and Northwestern Railroad grade to mile 39 was awarded during the year. This route will open up considerable potentially productive mineral land for exploration and development, and will connect another all-weather, ice-free port, Cordova, to the highway network.

Denali Highway.—Construction of this 162.9-mile route to connect Mount McKinley National Park—the Nation's second largest—to the highway network, was begun in 1951. The project has been prosecuted from both the McKinley Park and Richardson Highway (at Paxson) termini simultaneously, and is passable from Paxson 42 miles west to the MacLaren River, and from the park 82 miles eastward to the Susitna River.

Taylor Highway.—Construction of this 161-mile route was initiated in 1947 by Government forces. It connects Eagle, Alaska and Dawson, Yukon Territory, with the highway network, and, with Canadian roads, provides a 381-mile military bypass of the Alaska Highway. The project is approximately 95 percent complete, and is passable over its entire length.

Maintenance.—Transition of the Territory's economy from a seasonal to a year-round basis has necessitated a greatly enlarged program of winter maintenance. Since the road system traverses an area of continental size, where climate ranges from the comparatively moderate temperatures and heavy snowfall of the south coastal areas to temperatures of 70° below zero with light snowfall in interior Alaska, special maintenance methods and equipment are required. In keeping open the entire 1,200-mile primary system and approximately 1,000 miles of connected feeder and local systems, every type of modern snow-fighting equipment, supplemented by specially designed rotary plows believed to be the world's largest, is utilized. The Thompson

and Isabel Pass areas are now maintained open the year-round, in spite of 80-foot annual snowfalls and 100-mile-per-hour gales.

Access roads.—Of great importance to the public at large is the construction of access roads and highways into areas opened up for homesteads, homesites and recreational areas. The Alaska Road Commission works very closely with the Bureau of Land Management in this respect, referring all petitions for new roads to that agency and continually requesting advance information as to new areas to be opened.

The Governor of Alaska in his message to the 22d Territorial Legislature meeting in January 1955, urged greatly needed increases in motor fuel taxes. As a result a new tax of 5 cents a gallon was levied on all motor fuel sold and delivered and a tax of 3 cents a gallon was levied on aviation fuel. This will permit an increase in Territorial funds which can be made available for highway construction.

Recognizing the problems that increased highway use has brought to the communities of Alaska, the Department recommended enactment of legislation to authorize the Alaska Road Commission to construct and maintain roads within towns of Alaska. Under the basic act establishing the Commission in 1905, construction was only authorized to and between towns. The Department recommended legislation authorizing the construction and maintenance of roads within unincorporated towns and settlements, and the construction of through roads only, without maintenance, in incorporated towns. The necessary legislation was passed by Congress shortly after the close of the fiscal year and was approved by the President on July 14.

Alaska Public Works Program

A \$70,000,000 program of public works in Alaska was authorized by the Congress in 1949 by Public Law 264, 81st Congress. As amended, this act provides for continuance of the program through June 30, 1959.

The express purpose of the act is to foster the settlement and increase the permanent residents of Alaska, to stimulate trade and industry, encourage internal commerce and provide investment, develop Alaska resources, and provide facilities for community life.

In the fiscal years 1950 through 1955 inclusive there has been appropriated by the Congress for this program \$50,708,200. This has been sufficient to finance 113 projects. The projects are constructed by the Federal Government under contracts after competitive bidding. Upon completion they are sold to the applicant, municipalities or other public bodies. The projects must be sold to applicants at prices calculated to insure that the whole program shall return to the Federal Treasury not less than 50 percent of the total cost of the program.

These projects include schools, hospitals and other health facilities, sewer and water systems, libraries and other community buildings, and other useful types of community projects.

Of these 113 projects, a total of 35, costing \$8,524,844.64, have been completed and sold to applicants; a total of 26, costing \$9,332,178.44, have been completed and are in the process of being transferred to the applicants; 37 projects, estimated to cost \$25,592,200, are presently under construction and will be completed and transferred with all due dispatch; and the remaining 15 projects, estimated to cost \$7,112,600, will be started later in this building season or not later than the start of the building season which opens in May of 1956.

Proposed Transfer to Alaska of Mental Health Program

A vigorous attempt is being made to secure legislation to modernize commitment procedures and to transfer responsibility for and operation of the mental health program to the Territorial government. To assist Alaska in assuming this new financial burden, the legislation recommended by the Department provided grants amounting to a total of \$6 million over a 10-year period. Other features of the bill were an additional grant of \$6,500,000 to construct facilities for the treatment of the mentally ill in the Territory and a grant of public lands to assist in meeting the cost of the program.

Responsibility for the care of the mentally ill was initially assumed by the Federal Government because of the Territory's special circumstances at the turn of the century. It has continued as a Federal responsibility largely because of Alaska's limited financial resources. The Department and this administration have been vitally concerned with the shortcomings of the program, particularly with regard to the archaic commitment procedures established in 1905 and not since modified. The House Committee on Interior and Insular Affairs held a series of hearings in Washington and Portland, Oreg., on this subject, and favorably reported the Alaska mental health bill in July 1955.

At the close of fiscal year 1955 there were 359 patients under care at Morningside Hospital, Portland, Oreg., the institution under contract with the Department of the Interior for the care and treatment of Alaska's mentally ill.

HAWAII

The Department's continued interest in securing passage of Hawaii statehood legislation was again evidenced this year with the appearance of Secretary McKay before the House Committee on Interior and Insular Affairs in support of H. R. 2535, the Hawaii enabling legisla-

tion. Although the bill was reported favorably by the Committee, the measure failed of passage when a motion to recommit was adopted on the floor of the House.

The rising unemployment trend which last year was of considerable concern in Hawaii was reversed through a record tourist trade and increased Federal expenditures in the Territory. During the year workmen's compensation and unemployment insurance benefits were increased and the territorial minimum wage was raised.

Contracts totaling \$6,667,343.94 for public works projects were let. Of this amount highways accounted for \$3,625,893.14, or more than one-half of the total amount.

In the public health field, emphasis was given to the operation and support of programs for the prevention of disease, early diagnosis, prompt treatment, and effective rehabilitation. A highlight in the educational program has been a joint teacher, parent community instructional policy evaluation program involving 4,000 participants in 140 committees.

TRUST TERRITORY OF THE PACIFIC ISLANDS

The fourth year of civilian administration in the Trust Territory of the Pacific Islands was noteworthy because of steady progress in all aspects of administration, especially in the districts which were strengthened by a restaffing of personnel. Health and education facilities were expanded, the land claims and agricultural programs were strengthened, and there was an increase in goods exported. The year also saw the discontinuance of phosphate mining on Angaur in the Palau District and the close of the Island Trading Co., with the assumption of many of its functions by Micronesian trading companies.

The headquarters offices in Honolulu and in Guam have been consolidated on Guam. This move has greatly aided the rapport which exists among the Federal agencies and private concerns serving the Micronesians.

By Executive Order No. 51 of March 10, 1955, the island of Rota became a district. This action permits Rota to be administered as a district rather than as a special project of the headquarters operation.

In the education department a Micronesian replaced an American as a District Education Administrator. This is the first instance of a Micronesian assuming full charge of a district department. Another significant achievement was the establishment of five additional annual scholarships for Micronesians to go outside the Trust Territory for higher education. There are ten annual scholarships now available to Micronesians.

Progress in Public Health

The Public Health Department postgraduate education has been increased to include grants to four medical practitioners and four nurses. This is an increase of two men and two women over the previous year. For the men, this postgraduate training includes all phases of medical care and is accomplished at Hilo Memorial Hospital, Hilo, Hawaii. Training for nurses covers all phases of nursing care and is conducted at the Leahi Hospital, Honolulu, Hawaii.

At the end of the calendar year 1954, 22 students returned from the Central Medical School, Suva, Fiji, and were employed by the health department in their respective fields of medicine, dentistry, pharmacy, and laboratory work. Sixteen Micronesians received intensive training at a special school for sanitarians. Upon graduation they were given field assignments and initiated an expanded program especially in the outer islands.

A significant change will occur when island lepers and mental patients are transferred from Tinian and Saipan to their home districts. This move will reduce the daily care costs to one-third the cost of maintaining them at Tinian and Saipan. The patients will be under the constant care of Trust Territory physicians and all treatment will be in accordance with approved and up-to-date therapy.

Economic Development

Commercial ships started calling at Majuro in the Marshall Islands during the fiscal year. This change permits direct contact with the outside world and provides lower port costs. Interisland shipping has been strengthened in order to permit the districts to complete more field trips each year. These extra field trips have encouraged the Micronesians to process more copra for export. The copra is purchased from Micronesian trading companies by a United States commercial firm and sold in world markets.

Air transportation was speeded up by the acquisition of three SA-16 Grumman Albatross planes which are faster and carry more passengers than the retired PBY's.

The agricultural program has been strengthened and new stock and crops have been introduced. Major emphasis has been on subsistence crops and on coconuts and trochus for export.

All claims of the inhabitants for yen sequestered by military authorities in the war were settled during the year.

An appropriation of \$700,000 for new construction was granted for fiscal year 1955. Work on several much-needed projects was begun. New power plants at Koror and Ponape, leprosaria at Yap and Ponape, new housing and a new office building in Guam have been completed

and are now in use. Among the projects under way are two hospitals, a nurses' training school, six warehouses and major repairs to piers and wharves adjacent thereto. In addition to the \$700,000 appropriated, an additional \$281,500 was made available from savings in operations and local revenues, thus permitting a total of \$981,500 to be allocated for projects now in progress or to be started in the very near future.

During the year considerable progress was made in defining and delineating land and claims problems so important to the Micronesians. A survey team spent several weeks in Rota and was able to distinguish most of the public lands from private lands.

The Ponape District has homesteaded in excess of 1,500 acres of public domain to eligible islanders and is continuing this program. In the Palaus, over 400 acres of public land were made available to Micronesians for agricultural purposes.

Palau Congress Granted Charter

The granting of a charter to the Palau Congress marked the integration of newly acquired democratic concepts with traditional Palauan institutions. This is a step in the direction of self-government toward which the Palauan people and their Congress have been working for many years.

The Congress, like its predecessor, serves as an adviser to the District Administrator and is empowered to acquire and administer real property, levy taxes, disburse funds, and pass laws for the district. The elected leaders in "the deciding body for the people" are for the first time permitted to draw up their own budget based upon income derived from districtwide taxation and to formulate laws which will be submitted to the High Commissioner for approval.

The High Court opened its first criminal session since 1953 in Palau. A first sitting of the trial division was held at Namorik in the Ralik Chain of the Marshall Islands.

A detailed report of the administration of the Trust Territory was given to the Trusteeship Council in June 1955. One Micronesian adviser assisted the United States delegate.

GUAM

One of the most significant developments during the fiscal year was the increased revenue from taxation realized as a result of an accelerated tax collection program instituted in the Office of the Commissioner of Revenue and Taxation. Guam's estimated income from all sources for the fiscal year was \$7,975,000. Actual income was \$10,-

189,000, leaving a surplus of approximately \$2,314,000 which the Legislature appropriated to school construction, public utilities and capital improvements.

Public utilities expansion, with the full cooperation of Navy authorities on the island, has made good progress. A new government telephone exchange opened, serving, in addition to the government lines, approximately 100 telephones formerly maintained by the military services. Power rates set by the Navy for power generated in its plant have been readjusted favorably after a sudden increase instituted last November, and obsolete, deteriorating water mains are rapidly being replaced.

Specific capital improvements projects completed during the year were the tuberculosis wing of the new Guam Memorial Hospital dedicated on June 4; the new 12-room grade school in Umatac village; and a new bridge over the Talofofo River, replacing the bridge washed away during a 1953 typhoon.

Construction of the round-the-island highway continued, but completion of the final connecting link was delayed with advent of the rainy season. The Department of Public Works project for gradual paving of village roads and streets was given additional impetus, with paving completed in two villages and commenced in several others.

Preparation of the Health and Sanitation Code, the Insurance Code, and the Agricultural Code was completed and referred to the Legislature for enactment into law.

Perhaps the most important single problem now facing the Government of Guam is the lack of an adequate physical plant to care for the continually increasing number of school-age children. The problem is aggravated by the enlargement of the Air Force complement on Guam with a consequent increase in resident dependents. The Guam Legislature, recognizing the importance of an early solution, appropriated \$700,000 for a coordinated plan of school construction drawn by a select committee and submitted to the Interior Department. New Federal school construction legislation is pending in the Congress. The Office of Territories has been instrumental in persuading the House and Senate committees considering the measures to include Guam in their coverage. There is good reason to be optimistic about the enactment of such legislation in the second session of the 84th Congress. Existing Federal school construction aid statutes do not cover Guam.

AMERICAN SAMOA

The fiscal year has been marked by important steps toward a greater degree of self-government for American Samoa. A constitutional

committee has partially completed a draft constitution tailored to fit the needs of the Territory and based on the principles of American democracy. Increasing authority has been delegated to district governors and other local government officials.

Increased effort has been devoted to medical services and public health. Measures to carry public health consciousness into outlying villages have been intensified. Practically all typhoid fever cases had been eliminated by the end of the fiscal year. Emphasis on malnutrition detection at early stages has resulted in a low incidence of this preventable condition. Higher standards of sanitation and hygiene have been set.

In an endeavor to assist the people to help themselves in the field of education, village leaders have been encouraged to improve, and in some instances to construct new schools. This cooperative effort and the feeling of local responsibility which it emphasizes are essential ingredients of the policy of this Administration.

The strengthened economy throughout American Samoa is reflected in the annual report of the Bank of American Samoa. Total assets increased over \$165,000. The bank has had numerous requests for loans for the establishment of new business enterprises and for the development of existing plantations in Manu'a since construction of the dock and roads began in these outlying islands. General improvement in the economy is largely due to confidence among the people in the stability and the economic development program of the Government.

In accordance with the Government policy of providing incentive to industry the Van Camp Sea Food Co. has been able to bring its cannery into full production during the year and currently employs over 300 local people.

The lack of direct air transportation between Honolulu and American Samoa is one of the greatest deterrents to economic development. An important part of the current economic program is the development of Tafuna Airport for the accommodation of Pan American Stratocruisers on their South Pacific route. The PAA application to substitute American Samoa for its stop at Canton Island has been approved by the President of the United States. Nonscheduled flights from Honolulu to American Samoa have been approved by the Civil Aeronautics Board.

The agricultural extension program has been expanded to assist in developing agriculture on the village level, and to encourage each village to apportion its lands to crops that will be of maximum benefit. By means of pilot projects at the Experimental Farm and Dairy the Samoans are being encouraged to improve their poultry and livestock. Two thousand acres of cocoa, a cash crop, are now under cultivation as a result of an intensive cocoa planting program.

The total cost of operations during the fiscal year 1955 was \$1,565,101 as compared to \$1,575,723 in the fiscal year 1954, a drop of over \$10,000. Accrued revenues total \$591,317 in 1955 as compared to \$524,970 in 1954. Export values in 1955 jumped to \$1,270,548.10 from \$546,237.67 in 1954, largely due to the export of canned tuna.

THE VIRGIN ISLANDS

The reorganization of the Government of the Virgin Islands required by the Revised Organic Act signed by the President on July 22, 1954, took effect during the fiscal year. The Legislature established under the Revised Act, a unicameral body composed of 11 senators, met in its first regular session on January 10, 1955. At the same time the Executive Branch of the Government was reconstructed into nine major departments.

A Government Comptroller was appointed by the Secretary of the Interior on October 26, 1954. A Commission on the Application of Federal Laws to the Virgin Islands was appointed by the President on December 15, 1954, and it is expected that the Commission's recommendation will be submitted to the Congress on or about July 22, 1955. A contract for the preparation of a Virgin Islands Code was executed in the Interior Department, and an advisory committee was appointed by the Secretary of the Interior to assist in the codification of the laws.

A new system of accounting has been installed. Tax administration activities have been centralized in one office. A single treasury has been created to replace two separate treasuries of the former municipality of St. Thomas and St. John and the municipality of St. Croix.

The general health of the Virgin Islanders has been good despite the primitive sewage-disposal methods for large parts of the communities. The occurrence of two cases of typhoid fever points up the need for increased emphasis on sanitation.

Notable improvements have been made in the telephone systems throughout the Islands. During the coming year, the organization and accounting procedures will be improved to accomplish maximum control. Every effort will be made to develop an adequate potable water supply system. The sewage system will be extended. The pumping system for salt water fire protection and flushing will be improved and extended. As funds become available, it is anticipated that approximately \$3 million in special public projects will be started.

During the fiscal year the total insular revenues collected amounted to \$2,916,094 as compared to \$2,408,866 for the previous year, an increase of \$570,228. In accordance with the Revised Organic Act,

there was transferred to the Government of the Virgin Islands by the Federal Government, matching funds in the amount of \$2,026,207 and essential public projects funds in the amount of \$1,872,992.

THE VIRGIN ISLANDS CORPORATION

The Virgin Islands Corporation continues to be the backbone of the economy of the Island of St. Croix, where the growing and processing of sugarcane provides employment to the majority of the population. The 1955 sugarcane crop was slightly larger than the previous year, and operations in general were more successful than in prior years. In spite of low sugar prices, losses were reduced and a higher efficiency obtained.

The power plants on the two main Virgin Islands, St. Thomas and St. Croix, maintained steady growth in respect to generation, distribution, and consumption, and their operations continued to show a profit. During the year power was extended to several of the smaller islands and arrangements were made to extend power from St. Thomas to St. John, an important step in the development of the latter island.

The Corporation took over the operation of the former Air Facility and Submarine Base, St. Thomas, on July 1, 1954. Considerable progress was made in restoration of the properties and in developing them for the benefit of the people of the Virgin Islands.

CONSTRUCTION OF PUBLIC WORKS

In 1944 the Congress authorized a public works program to assist in the internal development of the Virgin Islands, and a total of \$11,303,592 has since been appropriated. No additional appropriations for this program will be made as Public Law 517, 83d Congress, known as the Revised Organic Act of the Virgin Islands, has provided for the Virgin Islands Government to construct its own public works.

A large quantity of specialized movable equipment, including X-ray machines, furnished and installed during the fiscal year 1955 in four hospitals earlier completed under the program, has provided unexcelled facilities for the development of extensive surgical and medical services, previously not available in the Islands.

During the fiscal year 1955 there were completed four schools on St. Thomas, including a high school in Charlotte Amalie and three rural schools, providing classrooms for 1,374 pupils; together with two schools on St. Croix, including a consolidated high and elementary school in Christiansted, and a rural school at LaVallee, providing classrooms for 1,235 pupils. An auditorium has been provided in

each of the high schools for use in the school programs and community assemblies.

Construction of four schools on St. John, including a consolidated elementary school in Cruz Bay and three rural schools, providing classrooms for 245 pupils, which will be completed in time for the school term beginning in the fall of 1955, will adequately supply all the necessary school plant facilities for the Island.

A secondary road being constructed between Cruz Bay on the west coast of St. John with Coral Harbor on the east coast will provide a long needed overland transportation route across the Island and will prove a valuable contribution to the economic development of the area. A new intercepting sewer on St. Thomas will be constructed during 1955 to supplement existing facilities.

Final projects planned for this program, for which plans and specifications have been completed and made available to the Virgin Islands Government for construction under the program authorized by the Revised Organic Act, include three schools in Charlotte Amalie providing classrooms for 1,950 pupils, and two schools on St. Croix providing classrooms for 810 pupils. These projects also include a road or parkway upon land lying behind the previously completed seawall on St. Thomas. The construction of these schools by the Virgin Islands Government will complete the projected school plant facilities for the Islands, and the construction of the road or parkway will provide an essential transportation route from Bourne Field Airport in the western section to the new housing development in the eastern part of St. Thomas, thus relieving the congestion on the one existing narrow thoroughfare, and contributing to the recreational development of the 30 acres of land reclaimed by the seawall.

LIQUIDATION OF PUERTO RICO RECONSTRUCTION ADMINISTRATION

The successful liquidation of the Puerto Rico Reconstruction Administration, pursuant to Public Law 276 of the 83d Congress, was accomplished during the year and the agency was closed on February 15, 1955.

The PRRA was conceived in 1955 as a relief organization to offset the ravages of nature and the economic depression which gripped the world in that period. The programs of the agency provided Puerto Rico with many needed benefits and improvements in a wide variety of sociological and industrial fields. By 1947, however, PRRA's basic mission had been accomplished, and the first liquidation efforts began. These culminated in the adoption of Public Law 276 referred to above.

In the 18-month period established by the law for the liquidation of PRRA, almost 10,000 mortgages and pieces of real property located in both urban and rural areas of Puerto Rico were disposed of by discount incentives. Notes of sugar cooperatives were settled by negotiation on the basis of the difference between the Government interest rate and that of private banking institutions.

The liquidation preserved \$2,619,786 in the PRRA revolving fund and realized \$5,379,685 through the sale of assets and settlement of mortgages. These amounts, together with additional assets of \$445,966 which accrued to the Federal Government, permitted the salvaging of a total of \$8,445,437, while eliminating a wholly outmoded and currently unnecessary activity of the Federal Government.

PUERTO RICO TRAINING PROGRAM FOR TECHNICAL ASSISTANCE

The Department of the Interior continues to serve as the Washington office of the technical assistance program for the Government of the Commonwealth of Puerto Rico, under a special agreement between the Secretary of the Interior and the Governor of Puerto Rico. During the fiscal year 1955, a total of 891 foreign nationals (including trainees, visitors and observers), representing every country of the world except the Soviet Union and its allies, visited Puerto Rico. The area from which these foreign nationals came and their sponsorship is shown below:

Sponsor	Latin America	Near East, Africa, and South Asia	Far East	China and Indo- china	Europe	Total
Foreign Operations Administration	313	45	110	17	2	487
FOA-Caribbean DOTS	99					99
United Nations and specialized agencies	81	19			2	102
Organization of American States	14					14
Other foreign trainees, visitors and observers (nongrant)	¹ 160	13	6	2	8	189
Total	667	77	116	19	12	891

¹ Includes 10 grants made by Puerto Rico under the Commonwealth exchange program.

NOTE.—United States visitors concerned with technical assistance (not in total), 58.

Office of the Administrative Assistant Secretary

D. Otis Beasley, *Administrative Assistant Secretary*



THE Administrative Assistant Secretary discharges the duties of the Secretary with respect to administrative management. He determines the basic policies and procedures governing the activities under his supervision and coordinates by direction the conduct of these activities. The Administrative Assistant Secretary serves as the Department's representative on these matters before congressional, inter-departmental, and public groups.

During the year he has acted as the Secretary's representative in formulating the Department's position on individual recommendations contained in the reports submitted to the Department by the Commission on Organization of the Executive Branch of the Government.

The Office of the Administrative Assistant Secretary directed the Department's emergency relocation planning, providing guidance for successful participation in "Operation Alert" May 1 to June 15, 1955.

A report for each of the divisions under his supervision follows:

Division of Administrative Services

Floyd E. Dotson, *Director*



THE Division of Administrative Services received additional work loads as a result of internal reorganizations within the Department, particularly with respect to the Office of the Solicitor and Office of Mineral Mobilization. It was able to maintain its full program

for development and direction of administrative services throughout the Department in addition to the housekeeping and internal operating services provided for the Office of the Secretary. The Division also provided other departmental units with centralized library, museum, employee health, space, telephone, photographic, warehousing and shipping, duplicating, and printing and binding services.

Branch of Library Services.—Use of the library continued at about the same rate as in 1954. Statistics for 1955 indicate: 32,713 reading room patrons, 17,900 telephone calls, 88,967 items circulated, 8,191 interlibrary loans, 17,075 research queries, 12,663 books and 65,537 periodicals received. Total library holdings rose to 434,601 volumes.

Fiscal Section.—Budgeting and accounting services were provided for the Office of the Secretary and other departmental units not attached to the bureaus. Expenditures were approximately \$6 million and working capital fund operations were over \$1,200,000. The Section also handled the approximately \$4 million transferred from other agencies for use by various bureaus in the Department.

Records Management.—A simplified filing system was installed in the Division of Security. Over 1,800 cubic feet of obsolete records were destroyed, 1,232 cubic feet of semiactive records were transferred from office space to storage areas, and 65 file cases, with a replacement value of approximately \$2,700 were released to other agencies.

Branch of Personnel Operations.—The 1955 work in the Branch increased approximately 40 percent because of the transfer of the legal staffs from the bureaus to the Office of the Solicitor in 1954. The Branch assumed this additional load and continued to supply all normal personnel services to the Office of the Secretary and other departmental units not attached to the bureaus.

Museum.—During 1955 more than 64,000 people, including 150 special school groups visited the Museum. Regular exhibits were modernized and 7 special exhibits were prepared to illustrate current Department programs.

Branch of Central Services.—Extensive reorganizations and realignments increased the work load over 1954, but all services supplied by the Branch were kept current. Statistics for the year show 17,500 duplicating jobs, 3,000 telephone changes, 8,000 dispensary treatments, 14,000 photographs, 3,000 printing and binding requisitions, and 2,100 procurement orders for the Office of the Secretary.

Division of Budget and Finance

Sidney D. Larson, *Director*



THE Division of Budget and Finance is responsible for staff supervision of budget and financial activities of the Department. It represents the Department in these fields in liaison with the Bureau of the Budget, other Federal agencies, and appropriation committees of the Congress.

Appropriations made to the Department by the Congress for the fiscal year ending June 30, 1955, total \$434,554,250. The receipts for the period, including trust funds, deposited in the Treasury of the United States were approximately \$435,600,000. This represents an increase in excess of \$166 million over the actual amount deposited in the preceding fiscal year. The increase is largely due to receipts from oil leasing of Outer Continental Shelf areas.

The Division developed forms and procedures designed to provide the Secretary and Assistant Secretaries with summary budget information from which policy decisions could be made on the magnitude of programs to be included in the departmental budget. Work was continued on improvement of budget justifications submitted to the Congress and the development of program schedules for support of construction estimates of the Bureau of Indian Affairs, National Park Service, and the Alaska Road Commission.

The Division participated in the joint programs of the Bureau of the Budget, Treasury Department, and General Accounting Office for improving accounting and fiscal reporting. Accounting surveys were instituted in the Fish and Wildlife Service and the Government of the Virgin Islands for improvement of accounting procedures and financial reporting. The accounting survey instituted for the National Park Service during the preceding fiscal year was completed. Continued assistance was provided other bureaus of the Department in accounting systems improvements and other fiscal matters. Accounting principles for the Alaska Railroad were approved by the Comptroller General. An accounting manual was prepared for the Bureau of Land Management and submitted to the Comptroller General for approval.

The Division continued to cooperate with the General Accounting Office and with the bureaus of the Department in the comprehensive audit program and provided the leadership for correcting deficiencies in fiscal and other matters brought out in the audit reports.

Division of Inspection

W. Darlington Denit, *Director*



THE Division of Inspection was established by secretarial order on March 19, 1955. This Division is responsible for the inspection and special investigation activities of the Department. The inspection program is aimed at preserving the high standards of moral and ethical conduct which have been traditional in this Department. The program was inaugurated in accordance with policy directives of the President and is seeking by means of systematic examination to evaluate the effectiveness of the regulations and procedures which control performance with respect to the conduct of employees entrusted with performance. It thus becomes an important phase of the continuing management improvement effort stressed in all Interior activities. This Division has provided policy and procedural guidelines and regulations for the inspection program. The actual inspection work is not undertaken by a centralized departmental staff, and it is a basic feature of the program that the bureaus assume full operating responsibilities. The Division will from time to time make surveys to evaluate the effectiveness of bureau inspection processes.

The investigative program covers special investigations of allegations of misconduct by employees and other administrative irregularities. Investigations of other matters within the responsibility of the Department are conducted as may be authorized by the Administrative Assistant Secretary. Where violations of criminal statutes are disclosed, cases are referred to the Attorney General for appropriate action. Cases involving certain types of irregularities are referred to the General Accounting Office pursuant to general regulations. Only limited investigative authority has been delegated to the bureaus.

This Division also provides staff assistance in the administration of the nondiscriminatory employment policy of the Department.

Division of Management Research

Arthur B. Jebens, *Director*



THE Division of Management Research provides leadership and assists in the development of policies and programs for the improvement of management as well as conducting studies concerning organization and management in the Department. In addition the Division continued to review proposed legislation, Executive orders, and administrative issuances for organizational and management implications.

The first half of the fiscal year the Division concentrated on providing assistance to bureaus in implementing the recommendations of the Secretary's survey teams. The Division's participation consisted of devising new methods of operation, outlining new patterns of working relationships, coordinating activities so that proper organizational balance was maintained, and guiding the total effort towards conformance with secretarial intent. These activities are now virtually complete with attention now being directed to a follow-up program to examine the results achieved.

The Division undertook the establishment of a departmental manual system as a result of a recommendation contained in a report of a survey group on manuals. The overall responsibility for operation of the manual system and for review and coordination of instructions published in it was assigned to this Division by the Administrative Assistant Secretary. The process of converting all information previously issued in the Official Organization Handbook and instructions contained in Secretary's orders, as well as those instructions of general and continuing applicability formerly published in nonmanualized form, is in progress. As a part of this project the Division has initiated a plan for assisting the bureaus and offices in reexamining and rewriting their organizational statements and manual systems.

The following reflects a cross section of projects and highlights the nature of staff assistance provided by this Division. The Division, or members of the staff (1) coordinated the preparation of special reports and replies to the Commission on Organization of the Execu-

tive Branch of the Government and its Task Forces, (2) helped develop, in connection with the emergency relocation plan, a list of essential wartime functions and personnel requirements, and a plan for organizing and managing the Department, including delegation of authority necessary under attack conditions, (3) assisted the Bureau of Indian Affairs in organizational matters involving centralizing responsibilities for tribal affairs in a single unit in the Washington Office, (4) developed the operating procedures and acted as chairman for the Board of Manual and Publications for the Department in reviewing Bureau publication programs, (5) studied and made recommendations to reorganize administrative services in the Office of the Solicitor and to streamline methods and procedures in the docket room, (6) reviewed the organization for and functions of the minerals mobilization program, assisted in determining staff and fund requirements and operating procedures and methods, and prepared a document establishing the Office of Minerals Mobilization, (7) acted as chairman of a group to consider means of implementing the recommendations of the departmental safety survey report, (8) prepared secretarial instructions instituting the departmental inspection program and assisted in the establishment of the Division of Inspection, (9) established detailed procedures for, and prepared material relating to, the Department's Committee Management program, (10) and inaugurated a management bulletin, *Management Highlights*, for departmentwide dissemination of significant management improvement information.

The Division also implemented an aggressive campaign to obtain improved operation through superior employee performance and suggestions by assisting bureaus develop effective incentive awards programs. This included providing bureaus with information on the best incentive award practices in the Department and in private industry and by further strengthening the bureau programs through evaluation of performance. The following summary reflects the Department's incentive awards activities for the fiscal year 1955:

	<i>Dollar savings</i>	
Number of suggestions received.....	1, 956	\$302, 597
Superior accomplishment awards.....	110	178, 882
Efficiency awards approved.....	5	744, 700
Superior performance awards.....	136	7, 553
Honor awards granted:		
Distinguished.....	34	
Meritorious.....	94	
Commendable.....	302	
Special acts.....	1	

Division of Personnel Management

Guy W. Numbers, *Director*



THE Division of Personnel Management devoted itself to the overall task of maintaining the Department's personnel program at a high level of service, the success of which has been confirmed through a recent survey of a large number of field offices indicating that the current policies, regulations and procedures are meeting field needs.

The number of employees in the Department decreased from the previously reported figure of 56,831 in 1954 to 55,107 in 1955 with a subsequent reduction in recruiting activities. Governmentwide pay rate increases for beginning engineers and scientists improved the Government's competitive position with industry in recruiting for people trained in these professions.

With the change by the Civil Service Commission to a career-conditional appointment system in the competitive service, the Department adopted a similar conditional system for appointment outside of the competitive service.

The Division served as a clearing point for overseas assignments and in adjusting the Department's personnel policies and procedures in the light of a revised Memorandum of Agreement with the Foreign Operations Administration.

The sixth departmental management training program was completed by 23 trainees, most of whom were selected from within the Department. Counseling throughout the year was extended to bureaus and offices on various forms of training programs. Assistance was provided on career development programs both within the Department and cooperatively with the Civil Service Commission.

Reports of investigation of personnel cases by the Division of Inspection were reviewed and recommendations made. Grievances and appeals coming to the Department level received attention. Health and safety matters were considered and counseling, blood donation, welfare and morale-building programs of the Department were coordinated.

New performance rating regulations were issued, the most notable change being the addition of an adjective rating of "excellent," thus reducing the spread of performance evaluation between outstanding and unsatisfactory.

Reports by the Civil Service Commission of inspections in Washington, D. C., and 70 field stations were reviewed and found to meet satisfactorily the standards required.

Careful analyses of the Hoover Commission recommendations relating to personnel were made in the light of obvious possibilities of improving personnel administration.

Lists of congressional bills relating to personnel and summaries of their progress since introduction were compiled and distributed to bureaus and offices.

Division of Property Management

N. O. Wood, Jr., *Director*



DURING fiscal 1955 the Division accelerated its activities in strengthening staff direction of the constituent bureaus of the Department, with particular emphasis on disposals of surplus and excess property, increasing the use factor on owned equipment, elimination of nonessential activities, and development of revised contracting techniques to protect the interests of the Federal Government. The staff continued to participate actively on interdepartmental boards and committees reviewing technical standards and administrative procedures, and initiated a number of internal actions designed to improve property management performance within the Department; collaborated in the preparation of initial material for those portions of the Departmental Manual governing phases of property utilization, procurement, construction contracting, and records management.

The Division placed into effect a number of new standards and revised procedures encouraging the exchange and transfer of un-

needed equipment between projects and bureaus, and accelerating the release of excess equipment and stores to other agencies or departments.

A study of the contracting practices of the Department and of other agencies resulted in the development of departmentwide procedures governing the negotiation of contracts.

A number of actual field tests were conducted to determine the feasibility of contracting for commercial-type services formerly supplied by Government forces. As these tests were completed and evaluated, action was taken to establish policies controlling similar categories of activity on the basis of securing services in the most economical manner. The Division cooperated with a number of task groups, study groups, representatives of other agencies, Congress and the Commission on Organization of the Executive Branch of the Government which were studying the methods and results of property management operations within the Department of the Interior.

The preparation of a records disposal schedule by this Division helped expedite the orderly liquidation of the Puerto Rico Reconstruction Administration. The Division assisted the Bureau of Indian Affairs in negotiating with GSA for the procurement of the services of a private management firm to review and improve the entire bureau reporting system. In addition, the services of GSA consultants were obtained on a reimbursable basis for the Alaska Railroad to activate a comprehensive records management program. Disposition of inactive and obsolete records continued satisfactorily; at the end of the year there were more than 75,000 cubic feet of inactive bureau records being stored and serviced by Federal Record Centers.

During the year 279 radio-frequency assignments were issued by the Department under Interdepartment Radio Advisory Committee authorization to provide for the radio-communication requirements of the offices and bureaus of the Department. A total of 248 individual frequency assignments were registered with the International Telecommunication Union. Implementation of project CONELRAD (Control of Electromagnetic Radiation) was essentially completed. Action was taken to minimize harmonic radiation from Interior ship-station transmitters and provision was made for the identification of structures which constitute a hazard to air navigation. Studies on emergency point-to-point communication systems and radio frequency usage within the Department were completed pursuant to requests from the Office of Defense Mobilization.

Division of Security

J. Cordell Moore, *Director*



THE Division of Security completed readjudication of all cases as required by Executive Order 10450 and at the close of the fiscal year was operating on a current basis.

During the year the Division installed a record system designed to show action taken on all cases handled by the Division including clearances issued by other agencies on Interior employees.

In the field of physical security the Division has continued its program of education on the handling of classified material and devoted considerable attention to the protection of critical facilities. Marked progress has been made in these fields despite the limited funds available.

The Division has taken an active part in the Civil Defense program of the Department and in planning for the various types of emergencies with which the Department might be required to cope. This program is being extended to the field installations and although this program is a continuing one with constant changes being the rule rather than the exception, it is believed that the Department is now in a state of readiness which will assure efficient operation under emergency conditions.

At the close of the fiscal year the Division was operating on a current basis with respect to all three phases of its responsibilities.

OFFICE OF THE SOLICITOR

J. Reuel Armstrong, *Solicitor*

THE decision was taken during the preceding fiscal year to make the Office of the Solicitor a "departmental" law office. It was clear that this goal could not be reached solely by a reorganization of the headquarters office in Washington, D. C. As long as attorneys in the field were assigned to serve particular bureaus, they would not be in a position to offer services generally in connection with the Department's operations.

Accordingly, early in fiscal year 1955 the fundamental change in the organization of the field service required to integrate the Office completely was made. Five regions were established in the Western States, and Alaska was made a sixth region. A regional solicitor was placed in charge of each region. At various locations in each region a number of field solicitors were provided for. Hearing examiners were made administratively responsible to the regional solicitor in whose region the examiners' headquarters were located. Regional solicitors were placed under the administrative supervision of the deputy solicitor and the technical guidance of the appropriate associate solicitor as to legal matters.

As in any change of this magnitude—particularly one that drastically departs from a pattern of long standing—the reorganization of the field service has raised problems, not all of which have been resolved. Yet the results have been encouraging. The regional solicitors have been diligent in pursuing the opportunity to establish balanced regional offices and to provide adequate legal services for all of the administrative personnel in their regions. The administrative personnel of the bureaus and the attorneys in the field have been most cooperative; and neither the need of various bureaus for "legal specialists" nor the differences between the regions of the bureaus and those of the Solicitor's Office have proved as formidable obstacles as they were thought to be.

The headquarters office completed its first full year as an integrated Office. There is ample evidence that the benefits expected from reorganization are being realized, in terms of elimination of duplication

in review, of greater ability to assign attorneys to meet demands upon the office, of a more closely knit performance of legal functions, and of fostering among the attorneys a feeling that they are a distinct professional group constituting legal advisers to the Department.

The considerable task of providing an efficient method of housekeeping for the entire Office has been accomplished with the assistance of the Office of the Administrative Assistant Secretary. A number of steps were taken to make the decisions and opinions of the Office much more accessible than they have been in the past. A new topical index was prepared under which are listed practically all decisions rendered and important opinions given both in the headquarters office and in the field. A cumulative index-digest of decisions and opinions is issued quarterly, and copies of opinions given in the headquarters office are regularly distributed throughout the entire office. Published decisions and opinions are issued monthly in "advance sheets" of the Interior Decisions.

Three important changes in the organization of the headquarters office were made during the fiscal year. In order to provide for a more manageable assignment of functions, the Division of Public Lands and Mineral Resources was reconstituted the Division of Public Lands and a Division of Mineral Resources was created. The Division of Appeals was abolished, and its functions were assigned to the Deputy Solicitor with the exception of contract appeals. Jurisdiction over the latter appeals was vested in a Board of Contract Appeals which was established in the Office of the Solicitor. The Board functions under regulations prescribed by the Secretary. It is composed of three members who are attorneys in the Solicitor's Office and five alternate members, four of whom are engineers in the Department. The creation of the Board has been well received by contractors and the bar.

New procedures for handling legislative reports went into effect during 1955. Views and data on bills affecting the functions of the Department are obtained from the various bureaus and offices by the Division of Legislation. Upon receipt of these comments attorneys specializing in aspects of the work of the Department then prepare reports, and the Division assumes responsibility, under the direction of the Solicitor, for the coordination and expediting of the reports. Experience during the first session of the 84th Congress indicates that the new procedures have made possible the handling of a substantially increased number of reports to the Congress and the elimination of many delays. The growing volume of requests for reports from the Congress is a continuous problem, as is illustrated by the fact that during the first session of the 84th Congress requests were received on 825 bills as compared with 680 for the 83d, and 657 for the 82d Congress.

A summary description of some of the more important aspects of the work of the Office of the Solicitor follows:

APPEALS AND CLAIMS

Some 161 tort claims, 52 irrigation claims, and 40 contract appeals were disposed of during the fiscal year. Of especial interest among the contract appeals were questions relating to the effect of a minimum wage schedule included in a contract pursuant to the Davis-Bacon Act (*Wiscombe Painting & Decorating*, 61 I. D. 423), the right to an equitable adjustment for extra work because of ambiguities or omissions in a contract (*Butler Construction & Engineering Co.*, 61 I. D. 412), the right to additional compensation and an extension of time because of the modification of a contract by an informal understanding between the parties (*Ryall Engineering Co.*, 62 I. D. 118), and a claim for water wasted in the operation of a reservoir by a departure from the established rule curve (*Georgia Power Co.*, IBCA-31). In *Arnold Streit et al.* (62 I. D. 12) prior rulings of the Solicitor holding that the provisions of a land purchase contract used by the Bureau of Reclamation barred recovery for damage to remaining adjoining lands were reversed, and the regional solicitors were instructed to reconsider all claims that had been disallowed on this ground.

Some 252 appeals in land matters were decided. Among the more important decisions rendered during fiscal year 1955 were several relating to oil and gas leasing. These included decisions holding that an applicant for a lease loses his preference right to a lease upon his failure to appeal from an erroneous rejection of his application (*Charles D. Edmonson et al.*, 61 I. D. 355); that applicants for acquired lands leases who did not comply with a mandatory requirement of the regulations because of an erroneous interpretation of the regulations by the Bureau of Land Management can be allowed a period of time to correct their applications, without loss of their priority over intervening applicants (*S. J. Hooper*, 61 I. D. 346, 350); that, in the absence of intervening rights, assent can be given after a lease expires to a suspension of operations and production in effect prior to the expiration of the lease so as to revive the lease term (*Robert E. Mead et al.*, 62 I. D. 111); and that a valid oil and gas lease terminates by operation of law when the lessee takes office as a member of Congress (*John E. Miles*, 62 I. D. 135). A departmental precedent was established in awarding all the tracts offered at public sale to one preference right claimant to the complete exclusion of another preference right claimant (*Arne Hoem et al.*, 62 I. D. 240), and in holding that a purchaser at public sale of Alaskan lands forfeits his purchase price and loses the land upon his failure to apply

for a patent within the time prescribed by statute (*Matanuska Valley Lines, Inc.*, 62 I. D. 243). At the close of the fiscal year there were appreciably fewer land appeals and contract appeals awaiting disposition than was the case at the beginning of the year.

INDIAN AFFAIRS

Some progress was made in reducing the number of heirship cases awaiting disposition. Four hearing examiners were added to the staff, and the clerical staffs of all examiners were made more adequate. A noticeable improvement in the service to Indian heirs has resulted. One of the most important and complex tasks of the fiscal year was the interpretation and implementation of the six termination bills passed by the 83d Congress. Legal problems of like importance and complexity were raised by the program looking toward similar legislation for other Indian tribes, as in the Sacramento region. The matter of termination of the Government's relationship to Indians presents some of the most challenging and perplexing legal problems encountered in the Department. The regulations relating to the revision of the roll of California Indians were revised and all enrollment appeals were disposed of so that the final roll was completed in accordance with the requirements of the act of June 8, 1954. The Menominee enrollment regulations and appeals procedure, required by the act of June 17, 1954, were amended. General regulations to govern enrollment appeals under four specific acts providing for termination of Federal supervision were promulgated.

In land matters during the past year renewed emphasis has been placed upon the need for the stabilization of restricted land titles which had become fixed under previous administrations but which have been recently subjected to question on the ground of disagreement or alleged mistake by oil companies, interested claimants, and field officials of the Department. Questions which have arisen in that respect arise principally from early probates of Indian estates. The Solicitor's Office has held that it is in the public interest not to disturb property rights. Moreover, our present policy is ordinarily to refuse to waive provisions of the probate regulations which fix time limitations which have elapsed for the reopening of estates. During the year a great amount of effort was also devoted to a clarification of the lines of civil and criminal jurisdiction between Federal and State Governments. In the Tulsa region over 1,400 appearances on behalf of Indians were entered in the courts of the State of Oklahoma.

The Office was called upon in connection with upwards of a hundred cases involving Indian affairs to which the Government was a party. Of particular importance were cases involving the use of the waters of the Colorado River (*Arizona v. California*) and of the Rio Grande

River (*Texas v. New Mexico*), the allotment of waters on the Agua Caliente Reservation (*Segundo v. United States*), the use of ground water for irrigation on the San Carlos Reservation (*Brophy v. United States*), the implied right of Indians to use water on the Yakima Reservation (*Ahtanum v. United States*).

LEGISLATION

The first session of the 84th Congress enacted legislation (Public Law 386) authorizing the Trinity project in California. Bills providing for the Colorado River storage project and the Fryingpan-Arkansas project are still pending, as are bills providing for the "partnership" development of the John Day, Cougar, and Green Peter projects in Oregon. Project investigations in Alaska by the Bureau of Reclamation were authorized (Public Law 322). Multiple uses of the surface of unpatented mining claims are now permitted and common varieties of certain materials, such as gravel and ordinary stone, are no longer covered by the mining laws (Public Law 167). Public lands in powersite withdrawals and reservations have been opened to mining (Public Law 359). A special statute provides for the exploitation of uraniferous lignite deposits (Public Law 357). The recordation of land scrip and warrants is now required (Public Law 257). Long-term leases of Indian lands were made possible by Public Law 255. The sale of a small tract of tidelands in Alaska as a site for a large pulp mill was authorized by Private Law 153. A bill to modernize the procedures in Alaska respecting mental health is still pending.

MINERALS RESOURCES

Increased legal services were required in connection with the Department's program for expanded cooperation with State and local agencies and private persons in the conservation, development and utilization of mineral resources. Numerous contracts and cooperative agreements were prepared and processed for research projects and investigations in the minerals field. The legal basis was established for cooperation between the Bureau of Mines, the States, and the Census Bureau in the 1954 Census of Mineral Industries. Work on exploration project contracts respecting strategic and critical metals and minerals continued to be an important aspect of the business of the office. Legal services were provided in connection with the assignment to the Secretary of additional defense responsibilities with respect to metals and minerals. The promotion and enforcement of safety in coal mines entailed considerable legal work in seven important proceedings before the Federal Coal Mine Safety Board

of Review. One of these proceedings resulted in a judicial decision that a State finding that a mine is gassy can be challenged only before State tribunals (*The Gauley Mountain Coal Co. v. Director, Bureau of Mines*). Two of these cases were pending in the Courts of Appeals at the close of the fiscal year.

PUBLIC LANDS

A considerable number of the regulations and procedures relating to the public lands were simplified and improved with the assistance of this Office. An editorial revision was made of the regulations relating to the public lands and appearing in title 43 of the Code of Federal Regulations, and certain of these regulations were completely revised. The regulations to implement the statute providing for multiple mineral development of the same tracts of public lands (Public Law 585, 83d Cong., 68 Stat. 708) were drafted and approved after extended consultation with representatives of the various mining interests. A thorough revision of the rules of practice in land matters was prepared and submitted to the public for comment. Emphasis was placed during the year in reducing the large backlog of cases involving the collection of overdue rentals in oil and gas, grazing, and other leases; the collection of trespass charges; and reimbursement for damage to public lands and resources. Many outstanding debts were collected in full or compromised or were referred to the Attorney General, or where the facts so warranted, were ordered reported to the General Accounting Office as uncollectible. Recommendations for the institution of suit were made to the Attorney General in a large number of cases, including five timber trespass cases aggregating more than one-half million dollars.

During the year the work of the Denver region was substantially increased by reason of the transfer to the field of the administration of the leasing of mineral lands acquired by the Department of Agriculture in connection with land utilization projects. Of some 7 million acres of such lands in the United States, over 6 million acres are within the Denver region. The Department's work under the Submerged Lands and Outer Continental Shelf Acts continued to present legal problems of importance. Opinions were given respecting the effect of a statute of the State of Louisiana purporting to fix the gulfward boundary of the State (M-36239), the effect of regulations under the Outer Continental Shelf Act on former State leases (M-36271), and the status of former State leases bisected by the line dividing the submerged lands from the Outer Continental Shelf (M-36259, 62 I. D. 44). Other important opinions dealt with State selections of mineral lands subsequent to 1860 under acts not expressly excepting such lands (M-36261), the availability under the Materials Act of a nonleasable

mineral on lands not covered by the mining laws (M-36256), and the limitation of access to through highways crossing public lands (M-36274, 62 I. D. 158). A far-reaching opinion held that desert land entries cannot be allowed in the State of Arizona where such entries depend on percolating water for reclamation since such water is not subject to appropriation under State law as required by the desert land act (M-36263, 62 I. D. 49). In two instances, the office successfully urged that action be taken to overcome the effect of significant judicial decisions adverse to the United States. One case involved a trespass occurring under a purported lease issued by a mining claimant (*Etcheverry v. United States*); the other, a refusal to enjoin a railroad company from drilling for oil and gas on its right-of-way (*United States v. Union Pacific Railroad Company*). Neither case had been finally decided at the close of the fiscal year.

TERRITORIES, WILDLIFE, AND PARKS

In connection with the Territories the Office was called upon extensively in connection with the enactment and interpretation of the Revised Organic Act of the Virgin Islands. Matters relating to property were of particular significance during the fiscal year. A distillery of the Virgin Islands Corporation and several small tracts of land were sold and agreements were made with respect to the administration by the Corporation of property formerly under the jurisdiction of the Navy. Surface vessels and airplanes no longer needed in the operation of the Trust Territory of the Pacific Islands were disposed of and a contract executed for the salvage and disposition of certain formerly enemy-owned vessels located in the Trust Territory.

An important part of the work of the Office was concerned with international fisheries—legislation designed to protect the interest of fishing vessels of the United States in the event of seizure on the high seas, the program for research and for the control of sea lampreys on the Great Lakes, the regulation of haddock fishing by the Northwest Atlantic Fisheries Commission. Opinions of the Office dealt with the authority of the Secretary to impose limitations upon the number of boats or fishing gear with respect to particular areas in Alaska (M-36276) and to regulate fishing on the high seas under the North Pacific Fisheries Act of 1954 (M-36273).

A twofold increase in the number of purchases of land for areas within the National Park System placed additional demands upon the office for legal services in this regard. The Office assisted in bringing about a procedural innovation under which superintendents of particular areas may issue special regulations. A new approach was taken to the problems posed by the existence of private lands in national

parks by proposing regulations that would make applicable to those lands certain of the laws of the States within which the lands lie. Of significance were opinions on the jurisdiction of the North Carolina State Board of Health over concessioners serving food on the Blue Ridge Parkway, the transfer of land from one area of the National Park System to another area, and jurisdiction over the waters of Jamestown Island, Colonial National Park.

WATER AND POWER

The wide scope of the Department's functions in the fields of water and power required a corresponding emphasis upon the provision of legal services essential to the discharge of those responsibilities. Extensive services were rendered in connection with the irrigation and power programs of the Bureau of Reclamation and the power marketing programs of the Bonneville, the Southwestern, and the Southeastern Power Administrations. These services covered matters relating to repayment and water service contracts under the Federal reclamation laws, the negotiation and amendment of contracts for the sale and exchange of hydroelectric power under the several statutes governing power marketing, and matters arising in connection with the procurement of materials, equipment and supplies by the Department's water and power agencies. During the fiscal year the office was called upon in connection with a number of important suits and administrative proceedings involving water rights in connection with the work of the Bureau of Reclamation. These cases are treated in some detail in the report of the Commissioner of Reclamation for the fiscal year.

CONCLUSION

The Task Force on Legal Services and Procedure of the "Second Hoover Commission" singled out this Office to observe that "A well-integrated legal staff is that of the Department of the Interior." An appraisal of the work during the fiscal year indicates that the Solicitor's Office functioned well as an integrated organization. The integrated Office was able without an increase in the legal staff to keep very nearly abreast of the heavy volume of work received during the fiscal year and in some areas, such as appeals, to reduce the number of pending cases. A good beginning was made in providing "departmental" legal services, and a sound basis laid for further improvements.

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